

# GENITO-URINARY DISEASES AND SYPHILIS

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## THE WASSERMANN REACTION

by

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SECOND EDITION REVISED

WITH 109 ILLUSTRATIONS

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# Preface to Second Edition

So remarkable—we might say epoch-making—have been the advances in the knowledge of genito-urinary diseases and syphilis during the past few years, that a revision has necessitated a rewriting of a major part of this book.

On this subject an adequate treatise of yesterday becomes an “outworn garment” of to-day, and no work could justly hope to reflect this important branch of scientific endeavor that fails to include the following notable improvements, which the writers have incorporated in this edition: The more satisfactory treatment of gonorrhoea; vaccine therapy; Rountree and Geraghty’s test for functional activity; pyelography; the Wassermann reaction and luetin test; the cultivation of the *spirochaeta pallida*; the use of the dark field illumination in the demonstration of the *spirochaeta pallida*; the inoculation of animals with syphilis, and the discovery of salvarsan and neo-salvarsan.

While the authors realize at least as fully as can any reader the shortcomings of the work, yet we hope it may prove of value to those who read it, in spite of its brevity in certain sections. We have purposely written briefly those sections which deal with the rare affections and unusual operations, in order to lay especial emphasis upon the commoner diseases. Much space has been devoted to the treatment of gonorrhoea, prostatic disorders, the diagnosis of renal affections, and the diagnosis and treatment of syphilis, especial detail being given to the indications, contraindications and technic of the administration of salvarsan and neosalvarsan. A full description is also given of the technic and interpretation of the Wassermann and luetin tests.

Attention is called to the treatment of incipient gonorrhoea by sealing argyrol in the anterior urethra with collodion, thus causing it to be retained in contact with the infected mucosa until the patient urinates. The prolonged action of a four or five per cent. solution of argyrol has a most satisfactory effect, and if the organisms have not extended more deeply than the part so medicated, the patient will be cured in four or five days. Little irritation is produced by the treatment, and the discharge often is not seen after the first treatment. If such remedial measure be employed it is of the utmost importance that it be applied early. Failure to obtain a rapid cure is likely when coitus has occurred during the incubation period of a previous infection. During the past five years we have cured more than seven hundred cases, with an average of five days or less for each patient. We urge a careful study of the technic, indications and contraindications before applying the method.

A summary of each chapter has been added to aid the student in his study and review for examinations and quizzes. We are indebted to Dr. J. Edgar Paulin for a full and lucid description of the Wassermann reaction.

We feel gratified that the members of an indulgent profession have encouraged us sufficiently to justify the launching of this edition, and the writers cherish the hope that in it may be found suggestions which may prove still further worthy of their confidence and materially aid the readers in the management of this often difficult class of maladies.

Atlanta, Georgia.

EDGAR G. BALLENGER, M. D.

OMAR F. ELDER, M. D.

# Preface to First Edition

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For a number of years it has appeared to the writer that the medical student is frequently placed at a disadvantage on account of either the minute detail of large and comprehensive works or the omission of important facts from smaller manuals and quiz compends which deal with Genito-Urinary Diseases and Syphilis. The writer's aim has been to present fundamental principles, and to enter at the same time into sufficient detail when considering matter of prime importance. He has not been entirely content to state generally accepted views, but has also set down the result of a somewhat close study of recent literature wherever it has seemed to accord with his own experience and that of recognized authorities. On this account the book may possibly prove of value to the general practitioner.

Selections from the writer's former contributions to medical journals have been used when deemed suitable. The writer desires to express thanks to the authors of the following works from which many valuable suggestions have been obtained: White & Martin, "Genito-Urinary and Venereal Diseases;" Taylor, "Genito-Urinary and Venereal Diseases;" Keyes, "Genito-Urinary Diseases;" also Keyes, "Syphilis;" Casper, "Genito-Urinary Diseases;" Deaver, "Enlargement of the Prostate, its Diagnosis and Treatment;" Bangs and Hardaway, "American Text-Book Genito-Urinary Diseases and Syphilis; Diseases of the Skin;" and Gouley. "Surgery of the Genito-Urinary Organs."

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# GENITO-URINARY DISEASES

AND

## SYPHILIS

### CHAPTER I

#### GONORRHOEA

GENERAL CONSIDERATIONS, GONOCOCCI, METHOD OF STAINING,  
ETIOLOGY, PATHOLOGY, SYMPTOMATOLOGY OF ACUTE  
GONORRHOEA, CHORDEE, BALANITIS, BALANO-POSTHITIS,  
LYMPHANGITIS, INGUINAL ADENTIS AND SUMMARY.

GENERAL CONSIDERATION.—The frequency of gonorrhoea and its disastrous and far-reaching results demand for it first place in a book on Genito-Urinary Diseases. Historical records show that gonorrhoea has existed since an exceedingly early date, Moses having laid down laws for the Israelites to be governed by in the management of "running issues," which we now believe to have been gonorrhoea. Much confusion has existed as to the etiology and nature of this disease; at first it was thought to be a "flow of semen," as a literal translation of the word indicates, then came its confusion with syphilis; and in settling this question of their identity, there arose one of the bitterest fights that has ever been waged in the medical world. To Ricord, the great French syphilographer, is due the credit of showing that gonorrhoea and syphilis were distinct diseases. Later Bassereau established the distinction between a chancre and a chancroid, while a clearer conception of these diseases soon lead to more rational and more effective treatment. Gonorrhoea is the most venereal of them, being nearly always contracted during sexual intercourse. It has a great tendency to lie dormant for considerable and variable periods of time, and to recur after sexual or alcoholic excesses.

Within recent times a much better understanding of the etiological role of the gonococcus in producing gynecological diseases in women has arisen, and we now know beyond doubt that even when derived from the latent infection in the male this germ may play havoc with the uterus, tubes and ovaries and the pelvic viscera, and that the gonococcus is the primary cause of a large percentage of the major operations in the pelvic organs or women. Gonorrhoea is also an important factor in producing sterility in both men and women. Its invasion of the prostate gland and seminal vesicles—along with urethral strictures, of which gonorrhoea is the most frequent cause—accounts for the majority of urinary and sexual disorders to which man falls victim. ✓

**GONOCOCCI.**—The gonococcus was discovered by Neisser in 1878, and is now conceded by all bacteriologists and genito-urinary surgeons to be the cause of gonorrhoea. It is a diplococcus, and in shape resembles a coffee bean. Gonococci multiply by fission, the line of cleavage being at right angles to the fine cleft separating them. The important distinctive features of the gonococcus are:

First.—It is found within the cells.

Second.—It is a diplococcus about 1 micromillimeter long and 3-4 m. broad.

Third.—It does not stain by Gram's method.

None of its characteristics can be relied upon implicitly, however, as there are other organisms which may be mistaken for them unless the entire clinical picture is considered. As a rule in acute conditions, where intracellular diplococci are found that do not stain by Gram's method, there need be little hesitation in pronouncing them gonococci, though Ayers has recently called attention to the difficulty or impossibility of distinguishing the micrococcus catarrhalis from gonococci

without a culture test. The former organism grows, however, on nutrient agar at room temperature, while the gonococcus will not grow at this temperature. The incubation period is likely also to be more variable than with gonococci. In chronic discharges even more uncertainty may be involved in the diagnosis.

Thalmann describes as follows an improved method for cultivating the gonococcus:

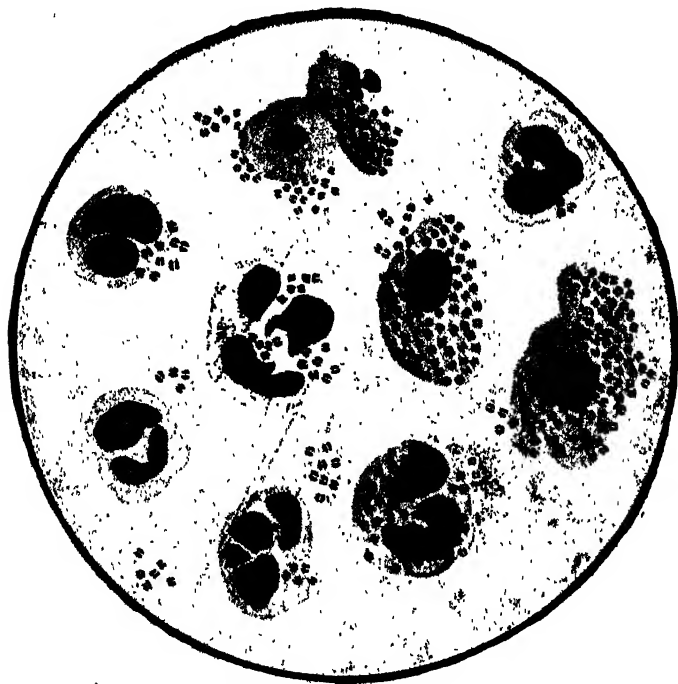


Figure 1.—Gonococci.

"Five hundred grams of lean, finely minced beef is placed in 1,000 c.c. of distilled water and allowed to stand over night in an ice box. It is then filtered and the filtrate made up to 1,000 c.c. with distilled water. To 100 c.c. of the beef juice add  $1\frac{1}{2}$  grams of agar and boil for fifteen minutes. Then add 2 grams of glucose and bring the reaction to plus 0.6 by addition

of NaOH. Tube, sterilize, slant and incubate over night. No peptone or salt is required. To each tube of the medium add 4 to 5 drops of fresh, sterile human blood-serum. After washing the glans penis with alcohol and wiping off any secretion at the meatus, a drop or two of the pus is expressed from the meatus and inoculated on the medium. It is best to incline the test-tube prior to inoculation, so that the serum will flow over the entire surface. The pus should be evenly spread. In sixteen hours the colonies of gonococci can be readily seen as small white dots. Toward the bottom of the tube the colonies are larger, sometimes almost as large as staphylococci when grown on ordinary media. By fishing out a small colony a pure culture can be obtained. In order to prove the presence of the gonococcus, make a Gram's stain, and transfer from the subculture to ordinary agar and Loeffler's serum. No growth should be obtained from either."

The pseudo-gonococcus may also be the cause of error as it is rather frequently found and is a diplococcus very similar to the gonococcus, but is larger and stains by Gram's method. It is well to be judicial and conservative, rather than dogmatic, in expressing an opinion where there is reasonable ground for doubt. The pseudo-gonococcus and other pyogenic microbes may cause urethritis, but as a rule this is milder than gonorrhoea and runs a shorter course or a very protracted course if it becomes chronic.

A positive diagnosis in certain cases can be made only by culture and inoculation or by the complement fixation test.

**METHOD OF STAINING.**—In routine work a weak aqueous solution of methylene blue affords a very satisfactory stain, but the gonococcus will take any of the basic aniline dyes. We have found Geimsa's stain for the spirochaeta pallida very useful and stable when prepared as follows: Azur I, .06 (grain 1),

azur II, .06 (grain 1), Geimsa's eosin, 2. (5ss), methyl alcohol and glycerin a. a. 45. (5iss). This stains the germs and the nuclei a dark blue, leaving the cell body very slightly stained.

Before obtaining the smears it is well to wash the meatus with 1-2,000 bichloride of mercury solution. The urethra is then gently pressed from above downward and the specimen taken with a platinum loop from the drop of discharge at or just within the meatus. This should be spread in a thin layer on a slide or cover glass and passed through a flame a few times to fix it, care being taken not to over-heat, as the cells may be changed and artefacts formed. A drop of the stain is placed on the smear and allowed to remain one-half to one minute; it is then washed in water and dried over a flame or with blotting paper. Examined now with an oil immersion objective a very clear view of the intra-cellular diplococci may be obtained. If there is doubt as to the infection being true gonorrhoea another specimen should be stained with methylene blue and then for three minutes with Gram's solution—iodine 1 part, potassium iodide 2 parts, and distilled water 300 parts. It is now washed in water and treated with absolute alcohol until the stain disappears and the specimen remains clear. Roux says that Gram's stain does not fix the basic aniline stains in the gonococci, and that when they become decolorized when subjected to alcohol, this indicates that the suspected organisms are gonococci.

Gram's method is to stain for two to four minutes with aniline gentian violet solution, freshly prepared each day. Transfer to the solution of iodine as just given, and allow to remain in it from one to three minutes. Place in absolute alcohol until completely decolorized and then stain for one-half minute in Bismark brown—1 part of a saturated solution to 15 parts of distilled water. Examined with an oil emersion lens the pus cells appear light brown and the gonococci as

decolorized spots in the cell body. This is considered the most reliable method of making a positive microscopic diagnosis. Where reasonable doubt exists, and the outcome is important, for instance, if the patient wishes to marry, cultures should be grown.

ETIOLOGY.—As previously stated, the gonococcus is always the cause of gonorrhoea which except in extremely rare cases, is contracted during sexual intercourse with a person having an acute, chronic or latent infection. Various factors increase the likelihood of such infection, as prolonged or excessive coitus, failure to cleanse thoroughly immediately after completion of the act, a long prepuce which retains the infected secretion in contact with the meatus, a virulent strain of the organisms, and lack of tissue resistance against the gonococcus—some patients being apparently more susceptible than others. The carelessness and urethral irritation caused by alcoholic beverages decidedly augment the chances of contracting all of the venereal diseases. It is sometimes impossible to determine whether a given urethritis is due to fresh infection or is a recurrence of a previous attack. A careful review of the history and the promptness with which the discharge appeared should be considered; as a rule the period of incubation is shorter in the recurrences of a chronic or latent condition. This, however, is only of relative value and must be considered with all the circumstances and evidence before expressing an opinion.

Besides gonorrhoea there are urethritides caused by other organism and toxic, chemical and traumatic agencies; the urethra may also be attacked by chancroidal and syphilitic infection. A careful examination and a properly stained preparation of the discharge will usually enable one to make a correct diagnosis without difficulty. Menstrual fluid has a reputation as a cause in the production of urethritis, but can only produce

gonorrhoea when it previously existed in the woman and gonococci are present, perhaps in the deeper organs. Sexual intercourse during or soon after this period renders infection more

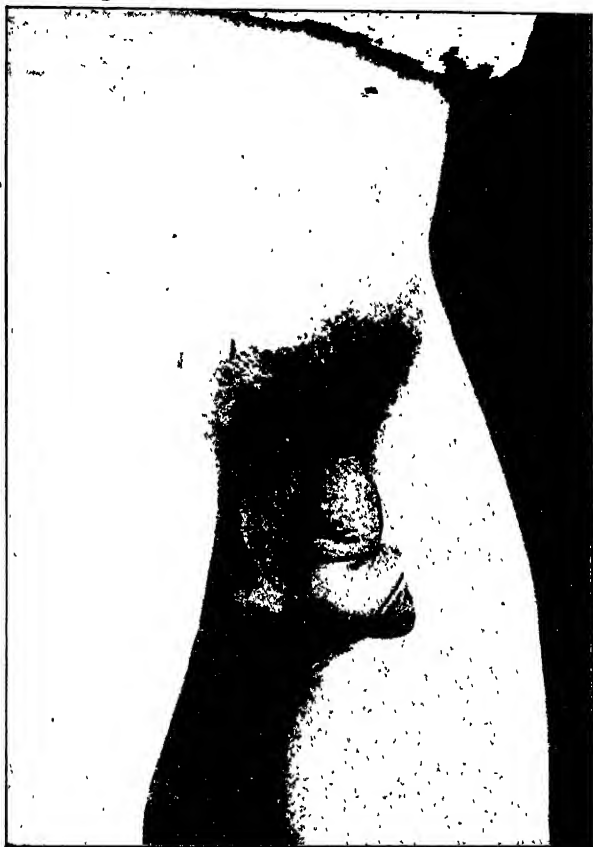


Figure 2.—Paraphimosis Complicating Gonorrhoea. (Morton.)

likely, as the latent germs may be stimulated to greater activity on account of the engorgement, and may be carried down into the vagina by the bloody discharge.

Irritating vaginal secretions may produce a toxic discharge or a urethritis may be caused by infection with other germs than the gonococcus.



**PATHOLOGY.**—The germs are usually implanted just within the meatus and at this point penetrate the mucosa and spread over a wider area by proliferation. Early in the disease they are found free in the discharge, then within the desquamated epithelial cells, and later within the pus cells. As they pass into the deeper layers of the mucous membrane the leucocytes and considerable serum escape from the capillaries. The infection enters the crypts of Morgagni and the glands of Littre, and spreads up the canal at a varying rate and with a varying degree of intensity in different patients. The mucous membrane becomes hyperemic, swollen, red and gives the meatus a pouting appearance. The amount of the canal involved depends upon many factors, as sexual intercourse during the incubation period, as intensity of the infection, dissipation, treatment, and the resistance of the patient, and if neglected or improperly treated the inflammation may soon reach the neck of the bladder and the ducts and glands in that region. The sub-mucous tissue in the corpora spongiosa becomes infiltrated, as may the perifollicular tissue, with a cellular exudate which prevents its distention as normally during erections. This produces "chordee," and if severe, frequent or if the "cord" is broken by force, the canal is damaged and considerable hemorrhage may follow. The repair by scar tissue and its subsequent contraction and the failure of submucous and perifollicular infiltration to undergo re-solution may result in a stricture of the urethra.

Indiscretions may cause the rapid involvement of the deep urethra, the glands of Cowper, the prostate and the seminal vesicles. These structures may become inflamed with an acute, sudden onset, or insidiously during the subsiding stage of the disease, and give no symptoms indicating their implication. The gonococci may pass into the seminal vesicles, down to the epididymes and testicles, where they produce an epididymitis

or epididymo-orchitis. Among other affections produced by gonorrhoea may be mentioned inflammation of the glans penis and prepuce, edema of the prepuce and phimosis, inflammation of the lymphatic vessels along the dorsum of the penis, inflammation of the inguinal glands, gonorrhoeal ophthalmia, gonorrhoeal arthritis, endocarditis and peritonitis. In the female the urethra, vulva, vagina, endometrium, Bartholin's glands, Skene's glands, and the tubes are the organs affected.

The urethritis may terminate by absorption of the cellular infiltration, the disappearance of the germs and finally the complete clearing of the pus and threads in the urine. Frequently this favorable result cannot be attained, and the reasons for the delay will be discussed under chronic urethritis.

**SYMPTOMATOLOGY OF ACUTE GONORRHOEA.**—During the period of incubation, which as a rule lasts from three to six days, there are no symptoms of gonorrhoea. The first manifestation of the infection is a slight itching or burning sensation at the meatus on urinating; about this time, or a little later, a clear mucous discharge is seen. The inflammation steadily increases, the itching and pain become more severe and the discharge changes to a mucopurulent one, and finally becomes profuse and purulent. If very acute it may be tinged with blood, or may have a greenish yellow appearance. When untreated the symptoms progress in intensity until about the 7th or 8th day, and then continue in the so-called stationary period for about a week. It then begins to decline, and in from four to six weeks the majority of skillfully treated cases are practically well; but the patient should be urged to refrain from excess of any kind for about a month longer and to take treatment until the cloudiness and shreds have disappeared from the urine, and gonococci cannot be demonstrated.

Among the more likely complications of an acute anterior urethritis are:

CHORDEE.—This is a severe pain which occurs during an erection, due to the fact that the infiltration of the mucosa of the urethra and tissue around it cannot expand *pari passu* with the corpora cavernosa. The consequent tension on the inflamed canal produces the pain.

FOLLICULITIS.—The follicles of the urethra are more likely to become inflamed during the acute than in the sub-acute or chronic stages, and when inflamed they appear as pea-size or larger nodules on the under surface of the anterior portion of the urethra. They are sensitive on pressure, but are not of much importance except as regards recurrent infections. Being protected from the urinary stream and arethral medication they form favorable sites in which gonococci may lie dormant. When the inflammation is severe in a follicle and its duct becomes occluded, or when it is injured during chordee, or from some other cause, the infection enters the surrounding tissue and a peri-urethral abscess may be formed. This may rupture into the urethra, through the skin, or if small it may disappear by resolution.



BALANITIS AND BALANO-POSTHITIS.—In neglected conditions the quasi-mucous membrane covering the glans penis may become red, swollen, and sensitive. If this attacks the lining of the prepuce it is called a balano-posthitis.

Occasionally the prepuce becomes so edematous and narrowed by the inflammation that it cannot be retracted and a foul smelling discharge is given off in large quantities. At other times the prepuce may be retracted back of the corona and the swelling in front so extensive that it cannot be drawn forward to its normal position. This is known as paraphimosis.

LYMPHANGITIS is an inflammation of the lymphatic canals running along the dorsal artery of the penis, and appears as a hard cord. A perilymphangitis is characterized by redness and tenderness in the skin over the cord as above described. Less frequently there is involvement of the small lymphatics in the skin all over the penis which causes considerable pain, redness and swelling.

INGUINAL ADENITIS.—The infection may reach the lymphatic glands in the groin and cause an inflammatory enlargement called "bubo" or adenitis. These may suppurate but are not so likely to as are those caused by chancroid.

THE DIAGNOSIS of an anterior urethritis is, of course, readily made from the discharge which should be stained and studied to determine the type of infection. Of even more importance is the question of finding whether or not the inflammation is limited to the anterior portion of the canal, for upon this fact depends the plan of treatment to be instituted, and also the prognosis. During the first week if the first glass of urine is cloudy and the second clear, and there is no frequency in urinating, it will be found as a rule that the disease is limited to the anterior urethra. At a later period this test is of no value as pus from the deep urethra may be washed out with the first urine leaving the rest of the urine clear. To determine positively if the posterior urethra is involved, (which is the case in about 80% after the first week), the portion of the canal in front of the "shut off" muscle, should be irrigated, a Valentine irrigator with an elevation of only about two feet being used. The urine passed after this will show, if it is clear, that the deep urethra (membranous and prostatic portion) is not involved. The deeper portion of the canal is nearly always more or less infected, even if not acutely inflamed. Murrell asserts that it is absurd for us to suppose that a gross macro-

scopic body as the compressor urethrae muscle can stop the upward course of microscopic gonococci.

PROGNOSIS.—The prognosis of anterior urethritis is good, and if the patient will carry out his instructions accurately and report regularly for treatment a very large percentage can be cured promptly and entirely, unless there be also present some debilitating systemic disease, such as tuberculosis. Syphilis and rheumatism also increase the difficulty of obtaining a prompt and thorough cure, but not to the same extent as does tuberculosis.

The prognosis, of course, depends upon one's success in preventing the infection from producing complications as prostatitis, epididymitis, seminal vesiculitis and inflammation of Cowper's gland and may be considered good as long as it is limited to the pendulous urethra, unless inflammation and erections have been very severe and a subsequent stricture seems likely. It should be explained to the patient that the discharge itself is not that which is to be feared, but rather the complications and chronic conditions that may follow, if the prostate and vesicles become infected, that this can be prevented only by most careful treatment and by his full co-operation from the first, and that even then we may sometimes fail.

SUMMARY.—Gonorrhoea is a common disease usually contracted from sexual intercourse and attacks the mucous surface of the genito-urinary organs. It is caused by the gonococcus, an intracellular diplococcus, which does not stain by Gram's method. Other organisms may cause urethritis resembling gonorrhoea. The gonococci or other germs, usually, are implanted on or just within the meatus and gradually extend into the deep urethral canal and infect the glands connected with it. The incubation period varies from three to eight

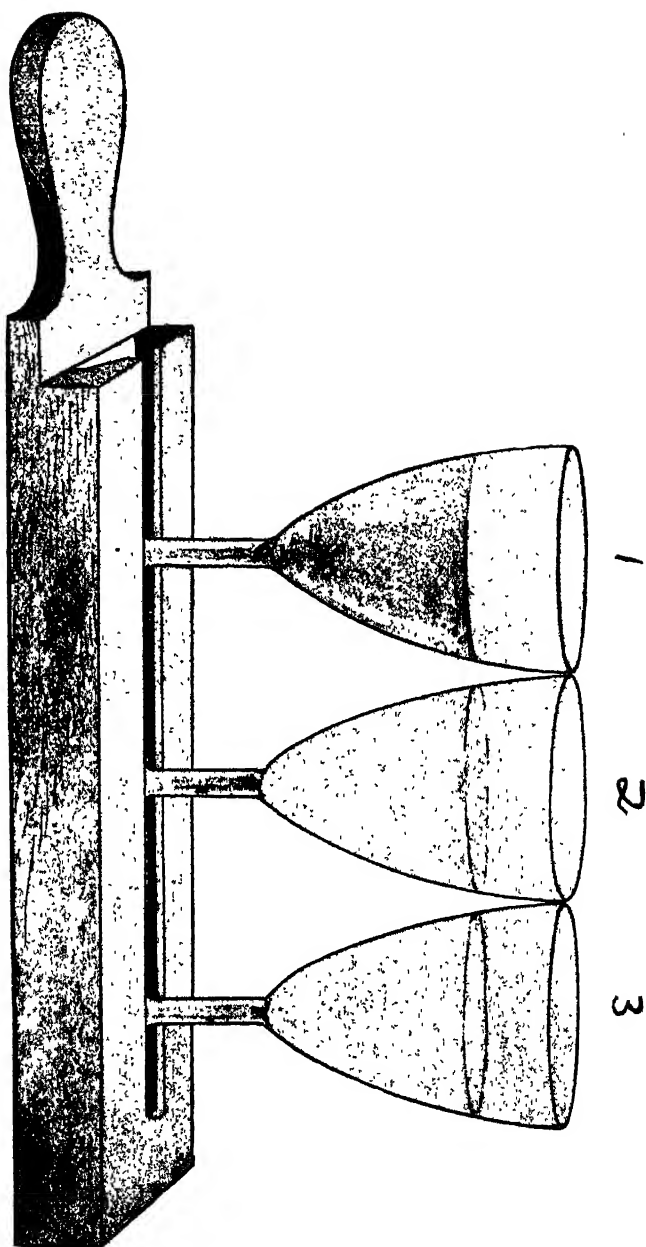


Figure 3.—Acute Anterior Urethritis—First Glass Cloudy, Second and Third Clear.

days—occasionally longer. The symptoms are, itching and burning at the meatus, smarting during urination, a purulent discharge, pus and shreds in the urine, painful erections, inflammation of the follicles along the urethra, balanitis, balanoposthitis, phimosis, lymphangitis, bubo and when the inflammation extends deeper, Cowperitis, prostatitis, seminal vesiculitis, cystitis, ureteritis and nephritis. The last three complications mentioned are rare. The prognosis is good, but depends upon the complications and upon the treatment.

## CHAPTER II

## THE TREATMENT OF ACUTE GONORRHOEA

THE SEALING IN ABORTIVE, TREATMENT OF URETHRITIS, TECHNIC  
GENERAL INSTRUCTIONS, DRESSING OF PENIS, ROUTINE  
TREATMENT, IRRIGATIONS, IRRIGATING SOLUTIONS,  
METHOD OF ADMINISTERING IRRIGATIONS, INJECTIONS,  
METHOD OF ADMINISTERING INJECTIONS, INTERNAL  
MEDICATION, TREATMENT OF COMPLICATIONS OF  
ANTERIOR URETHRITIS, PHIMOSIS, PARAPHI-  
MOSIS, FOLLICULITIS, PERI-URETHRAL  
ABSCCESS, BALANITIS, LYMPHANGITIS,  
BUBO, AND SUMMARY.

“SEALING-IN” ABORTIVE TREATMENT OF BEGINNING GONORRHOEA.—When the patient presents himself for treatment within twenty-four to forty-eight hours after the appearance of the discharge, gonorrhoea may often be quickly cured by sealing a 5% solution of argyrol in the anterior urethra once daily for about five days. We have tried various expedients in sealing the argyrol in the urethra, but nothing has been found to work as well as non-contractile collodion (U. S. P.). Success in the treatment depends upon two things; first, the organisms must be limited to the portion of the canal containing the argyrol; second, the medicine must be retained for at least six hours daily. If the solution is kept in contact with the entire inflamed and infected mucous membrane success is sure to follow the treatment; if the germs have extended beyond where the argyrol solution is retained the method is sure to fail. Sexual intercourse during the incubation period reduces the chance of a quick cure about 50%, especially if it is indulged in just before the appearance of the discharge. A prolonged in-



cubation period also lessens the chance of abortion. Any treatment, such as irrigation, instrumentation, or deep injection before the sealing-in treatment is begun renders it of almost certain failure. We have now cured about seven hundred and fifty patients within three to six days by this method and know of no treatment for any disease which is as satisfactory as is this quick cure of gonorrhoea, where care is exercised in its application. It matters not if the urethritis is caused by gonococci, staphylococci, colon bacilli, pseudo-gonococci or other organisms, provided the infection has not extended beyond the mucous surface subjected to the medication. Occasionally one will find already developed a perifollicular inflammation or abscess which harbors germs that are not reached by the solution and thus makes a quick cure impossible. After four years' experience with this method we have learned to predict with considerable accuracy the probability of a quick cure or the chances of failure. When all conditions are favorable we cure about 90% of the patients with gonorrhoea in five days and let them prove the success of the cure by drinking a few bottles of beer on the sixth day. If we have failed it is important that we know it at the earliest moment. There is never any "middle ground." The cure is absolutely complete or the disease will recur actively as acute gonorrhoea in two to four days. Where we are in doubt as to whether the disease has extended too deeply to cure by this method we often give a few tentative treatments, pressing the solution rather deeply in the canal hoping thus to bring it in contact and keep it in contact with all of the infected surface for at least six hours daily. If improvement follows, the treatments are continued daily until the cure is effected or the organisms in the deeper part have caused sufficient inflammation to show that this method is only reaching part of the infection and should therefore be discontinued. A most important feature of this treatment is that no harm

is caused by it even when it fails to cure the infection quickly. It usually renders the subsequent course milder. We have probably administered 4,500 of these treatments during the past four years and have never seen a stricture or any harmful results produced by them. When successful it shortens the treatment from weeks to days and as it effects the most satisfactory cures that we have ever attained and does it without injury or much discomfort we urgently recommend a careful application of this method, for we are daily convinced of its value as we are also of the germicidal power of argyrol when so placed in the urethra. Laboratory tests are said to show that argyrol has no bacterial action. Such apparent discrepancies will give little concern if the microscopic pictures of a few successful treatments are followed for a few times. Often it is impossible to find gonococci or even discharge after one or two treatments, though they both were plentiful one or two days previously.

If "moments" are ever "golden" it is in the beginning of gonorrhoea and all patients cured by this method are so impressed with this fact that they rarely ever delay coming promptly when subsequent infection is suspected.

This sealing-in treatment does no damage in chronic inflammation of the urethral canal. The beginner is advised therefore to practice upon such conditions so that when recent inflammation is encountered the solution can be properly placed in the urethra and retained there the necessary time. Unless a certain amount of practice and skill have been acquired the chances are that the collodion may not hold and failure will promptly follow. After a little practice it is very easy to cause the solution to be retained for six to ten hours or longer if but little water and liquid food have been taken previous to the treatment and while the argyrol is in the urethra.

TECHNIC.—The patient empties his bladder and reclines upon an operating table; the penis is well cleansed and surrounded with a clean towel; a small blunt pointed urethral syringe, so gauged that exactly 25 minims may be injected, is now used to place this amount of a 5% solution of argyrol in the canal. The meatus is pressed from side to side as the syringe is removed and the towel is then used to dry well the glans pe-

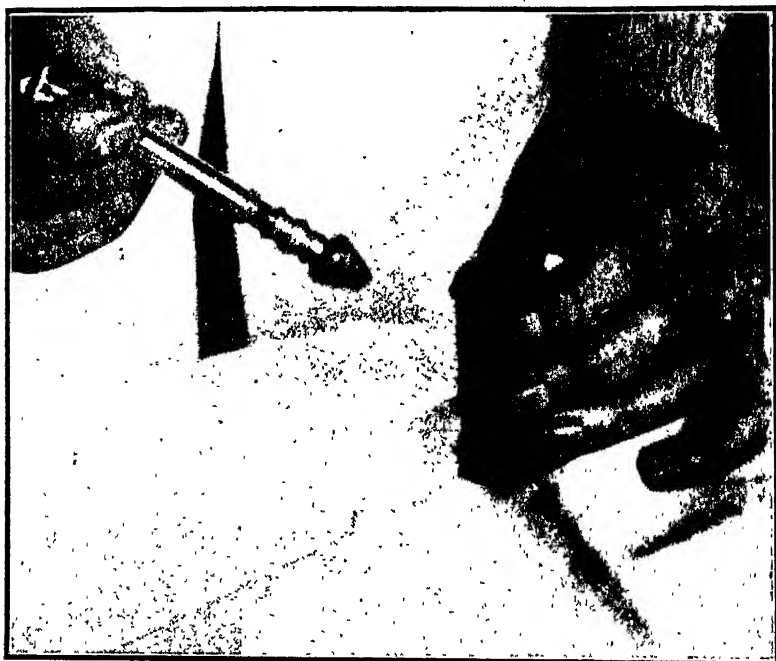


Figure 4.—Argyrol about to be injected into the urethra in which it is to be sealed with collodion.

nis. The lips of the meatus are pressed closely and smoothly together and are lightly brushed twice with collodion on a camel's hair brush. The collodion may be made to dry more rapidly by fanning, and it is of great importance to hold the argyrol solution back until the collodion has thoroughly dried and feels hard to the touch.

From conversations with other physicians who have used or tried to use this method of quickly curing gonorrhoea, it seems that most of them have failed because they injected too much of the solution into the canal, or because they did not let the collodion dry thoroughly. Experience has shown that 25 minims of the solution is sufficient and where more is used

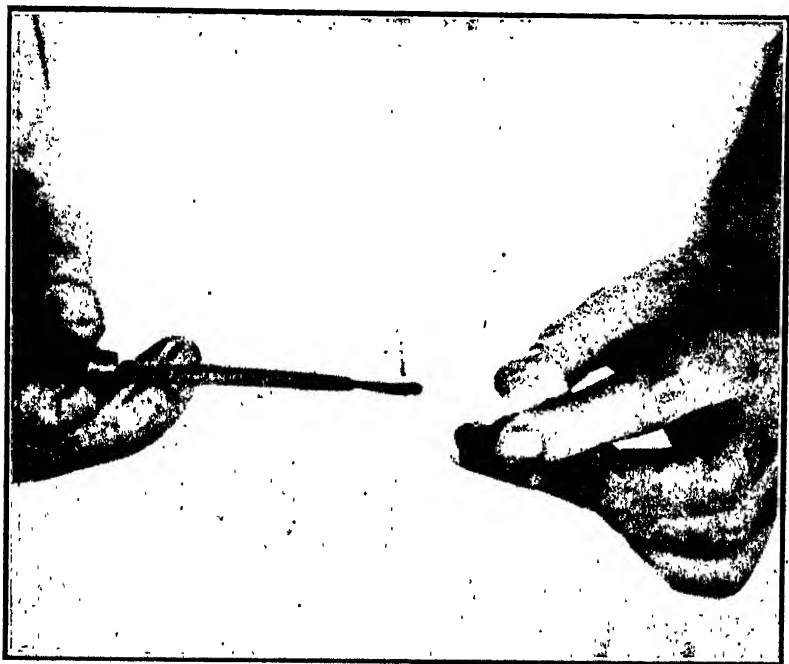


Figure 5.—Argyrol being sealed in the urethra. The pledget of cotton is not over the meatus but is over the glans penis. Part of the cotton is trimmed away so as to leave a small tag.

it only incurs the danger of leakage and may spoil the treatment. To get the beneficial effect of the medicine one needs only enough of it to wet thoroughly the mucous membrane. The patient is allowed to go back to his accustomed work unless it entails violent exercise, and he is advised to avoid liquids of any kind until the treatment is removed. He is cautioned

to hold it in the canal as long as possible. The collodion may be removed by applying a pledget of cotton wet with acetone which readily dissolves it. The meatus is compressed by the patient at the same time he applies acetone, to prevent the soiling of his linens with the argyrol. An even more satisfactory method than this is to hold a bit of cotton on the glans penis (as the meatus is sealed) so that the collodion at one point

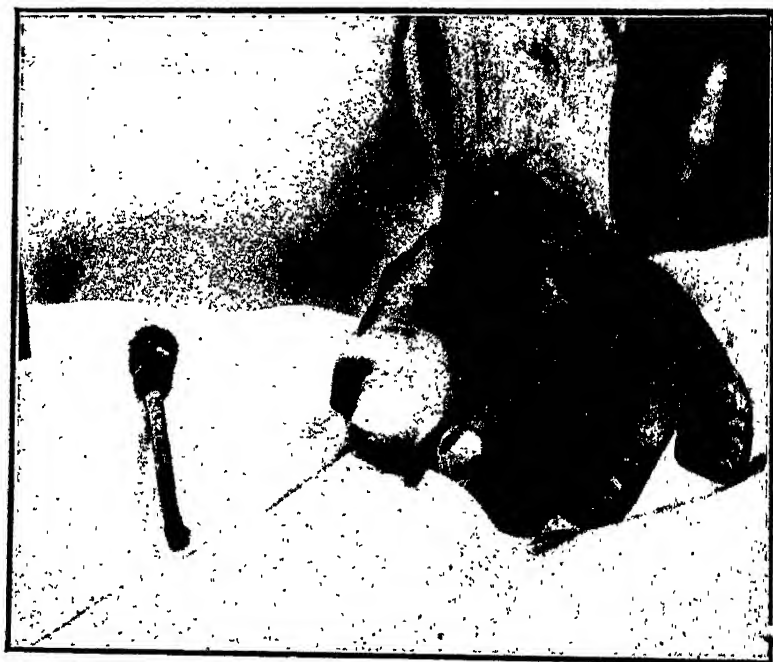


Figure 6.—Meatus sealed and the cotton trimmed.

comes over the cotton and thus gives a tag by which it can be removed with very little pain, without the use of the acetone to dissolve it. The pledget of cotton should not overlap the meatus or it will allow the argyrol to escape. After the collodion has been removed the patient should drink at least a half gallon of lithia water before he retires so as to flush well the canal and overcome the slight chemical and

mechanical irritation produced by the solution of argyrol. He should also be instructed to take very little of water and liquid food on the following morning in order that the next treatment be not interfered with by a free flow of urine. He should also report early for treatment so that it may be repeated later in case the sealing should not hold satisfactorily. It is better not to bind up the penis in cotton to protect the clothing as it may prevent his detecting it when the medicine escapes in case the collodion breaks, and thus he may lose valuable time. We have records of a few patients cured by one treatment, but such a result cannot often be expected. It is advisable to give the treatment for at least five days. Occasionally a return of the disease will follow when the cure seemed complete. Such results are probably caused by organisms being protected within a follicle. Solutions stronger than five per cent. seem to give no better results than solutions of this strength and may irritate the canal. Occasionally toward the end of the treatment, especially if it has seemed expedient to give more than the usual number, solutions as weak as two or three per cent. are used. A convenient way of keeping the collodion is to slice the small end of a cork with a sharp knife and stick the handle of the camel's hair brush into it so that the brush part is kept in the collodion.

Occasionally when a supposed cure relapses a repetition of the course of treatment will succeed, but as a rule it indicates that the organisms have extended too deeply to expect a quick cure. If the discharge containing gonococci can be detected after the third or fourth treatment and if the urine shows cloudiness in the first glass, the chance of a cure by this method is very slight and should be substituted by irrigations and the usual measures.

The solution of argyrol should be freshly prepared each day, as a stale solution is less potent and is more irritating.

**ROUTINE TREATMENT.**—When once well established and so spread that the sealing-in treatment fails or seemed from the beginning inadvisable, the routine treatment of gonorrhoea should be begun at once and should consist of irrigations, injections and internal medication.

**GENERAL INSTRUCTIONS.**—A well ordered life is of the utmost importance and is as essential as the treatment, no matter what part of the genito-urinary system is affected. Sexual excitement should be avoided—dalliance with women and prolonged ungratified sexual desire being particularly harmful. Coitus of course should be forbidden absolutely.

All alcoholic and carbonated beverages are to be interdicted, and in their place such drinks as limeade, lemonade, "lemon, lime and lithia," and lithia water are suggested. Highly seasoned and stimulating food and especially condiments, gravies, pastries, tomatoes and asparagus should be avoided, coffee and tea should be allowed only in moderation. The patient should be urged to drink large quantities of milk or buttermilk. The diet should consist mainly of cereals, green vegetables, potatoes, eggs, rice and bread, and these should be taken always in moderate quantities so as not to overload the urine. Moderate smoking does not appear to be particularly harmful, but becomes so if indulged in excessively. The same may be said of chewing tobacco. Nothing in the treatment is of more importance than to flush the urethral canal frequently with bland non-irritating urine, and this is best obtained by urging the free ingestion of plain water and lithia water.

If the bowels are inactive a compound cathartic pill or some such laxative should be taken perhaps every other night, or as indicated.

**DRESSING OF THE PENIS.**—This is of considerable importance and is most suitably attained by the use of a suspensory

with separate compartments for the penis and the scrotum. The penis should be surrounded with cotton to catch the discharge and the stain from the injections. In case the patient does not care to provide himself with one of these suspensories, he may so place a long pledget of absorbent cotton that the ends are held under the foreskin leaving a loop over the meatus in order not to prevent the free out-flow of discharge; or a hole may be cut in a piece of gauze two inches wide and three inches long

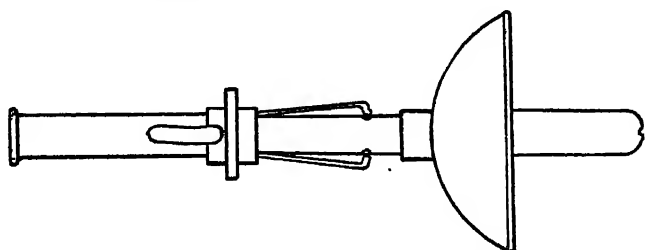


Figure 7.—Hand Piece of Valentine Irrigating Apparatus.

which is placed on the penis so that the opening is just back of the corona. The gauze is then wrapped around the gland and the foreskin pulled forward to hold it in place.

Every patient should be impressed with the danger of infecting the eyes and shown the importance of cleanliness.

IRRIGATIONS.—The Valentine irrigator affords the most satisfactory means of irrigating the urethra and bladder as varying pressure may be readily obtained as desired. A suf-

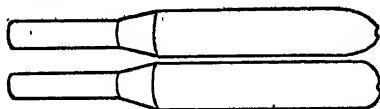


Figure 8.—Correct Shape for Irrigating Tips.

ficient number of blunt pointed glass irrigating nozzles should be provided so that a freshly boiled one is at hand for each patient. After being used the nozzles should be placed in a



porcelain tray so designated as to eliminate any possibility of mistaking the used ones for the sterile ones.

IRRIGATING SOLUTIONS.—In routine work we find the best solution with which to begin treatment, is a weak solution of potassium permanganate in a physiologic salt solution. An easy method of regulating the amount of permanganate is to keep a saturated solution in stock and of this add two grams (one half drachm) to each liter (one quart) of hot water (about 105 degrees F).

An easily dissolved solution of boric acid and carbolic acid may also be made in the following manner: boric acid is mixed with carbolic acid until a thick paste results. To this is then added a saturated solution of zinc sulphate equal in amount to one-eighth carbolic acid employed. A teaspoonful of this mixture dissolved in two liters (two quarts) makes a solution of value in the treatment of gonorrhoea during the subsiding stage or in chronic conditions where the amount of pus is slight or when the prostatic inflammation makes it difficult for the patient to empty the bladder completely after the irrigation. Retention of the permanganate solution will cause considerable pain and frequency of urination for a few hours following the treatment. Such, however, is not the case with the boric carbolic solution. Stubborn acute or sub-acute inflammation sometimes yields to a 1 to 8000 or 1 to 6000 solution of nitrate of silver, or 1 to 1,000 aluminum acetate when not favorably influenced by the previously mentioned irrigations.

Paradoxical as it may seem, patients will usually make more rapid and more satisfactory progress when these weak irrigations are employed than when the stronger ones, having greater germicidal power, are used. Patience, cleanliness, gentleness, and persistence are more essential than the quality of the germicide which can only affect organisms upon the surface which are washed away by the weak solution and the

mucous membrane thus left in a better condition to combat the organisms embedded in it than if chemically injured and irritated.

Under almost no circumstances should instrumentation of any kind be employed as long as gonococci can be found in discharge or shreds or are suspected of still being present. Such procedures increase the danger of complications, spread the infection and render the subsequent cure more difficult.

Occasionally it is better to alternate the irrigations than to use the same solution continuously. If the sealing-in treatment fails or if the infection has existed for a week or more, we must assume that the infection has extended beyond the "cut off" muscle and therefore the solutions should be carried back into the deep urethra and bladder. This does not increase the danger of complications, but in reality combats the infection which has already spread to this region. If doubt exists as to the extent of the inflammation, it is a very easy matter to settle by irrigating the anterior urethra before the patient urinates and observing, in the urine then passed, whether shreds are present or absent.

**METHOD OF ADMINISTERING THE IRRIGATION.**—Before each treatment the patient should urinate so as to wash out any gonococci that might be carried into the deeper parts, and by passing the urine into three glasses the medical attendant can watch the progress being made. While the glans penis and prepuce are being washed with 1-3000 bichloride of mercury, and during the subsequent irrigation, the patient stands and holds a porcelain basin in which to catch the fluid. With the penis grasped between the thumb and forefinger of the left hand, and with the hand-piece of the irrigator in the right, the stream of fluid is allowed to play just within the meatus and fossa navicularis in order to render it as free from infection as possible, before the solution is allowed to pass deeper.

The irrigating nozzle is now pressed against the meatus for a moment, and released as soon as the anterior portion of the canal becomes slightly distended. Toward the end of the treatment a little more pressure may be exerted on the meatus to insure thorough medication and cleansing of all the folds. For such an irrigation of the anterior urethra the retort containing the solution should not be elevated more than two feet above the penis. If slight burning is experienced before the regular amount of solution has been exhausted, the treatment should be discontinued. Properly given irrigations should not cause pain and as a rule, if there is any, it may be assumed that the proper technic has not been accurately followed. For the first few days of acute anterior urethritis two irrigations should be administered daily until the discharge is checked; one every day should then be continued until the cloudiness has disappeared from the urine and until the discharge has ceased. Thereafter, a treatment every other day is sufficient and one of the astringents as aluminum acetate or silver nitrate may be substituted for or alternated with the permanganate irrigations until the shreds disappear.

To obtain irrigations of the bladder the retort containing the solution should be elevated toward the latter half of the treatment and the patient told to attempt to void his urine; this causes a relaxation of the membranous urethra and with the nozzle pressed a little more firmly against the meatus the solution passes back into the bladder. The solution is then voided and the procedure repeated two or three times.

Along with the irrigations and vaccine treatment, the patient should administer the injections and take the internal remedies.

INJECTIONS.—Since the discovery of the milder organic silver preparations the injection method of treatment has been receiving much attention. It has proved to be of value when

used either alone or in conjunction with irrigations once or twice daily.

A large number of so-called organic silver salts do not cause such severe pain as does silver nitrate. These are thought to be of less value as germicides, yet when injected into the urethra they lessen the symptoms. Among these may be mentioned argyrol and protargol. It has been claimed that argyrol possesses little bactericidal action in test tubes, but when injected into the urethra our experience with its use for 11 years has convinced us that we have no other preparation which will so satisfactorily stop the discharge and allay the symptoms in the acute stage, if it can be brought in contact with the inflamed surface and such contact maintained or repeated at frequent intervals.

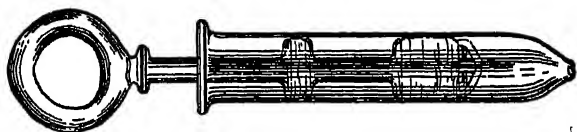


Figure 9.—All glass urethral syringe with asbestos packing over piston.

**METHOD OF ADMINISTERING THE INJECTIONS.**—Much care should be taken in explaining and demonstrating to each patient the proper method of administering the injections, as upon it depends the success of this part of the treatment. The syringe should be blunt pointed and of about two drachms capacity with an easily working and accurately fitting piston. The syringe should be thoroughly washed and kept sterile if possible.

The patient should be instructed to urinate always before taking the injections, and if he has no urine in his bladder the treatment should be postponed until the urine has collected sufficiently to flush out the urethra and wash away any gonococci or pus cells containing them, in order that they may not be deposited deeper in the canal by the treatment. After urin-

ation, the glans penis and meatus should be washed with several pledgets of absorbent cotton which have been dipped in a 1-3,000 solution bichloride of mercury. The syringe having been filled with the solution and the air bubble expelled, its point is then gently introduced just within the meatus and the solution injected until there is a slight feeling of fullness in the urethra. The meatus is grasped on each side and pressed together so as to prevent the escape of the medicine when the syringe is removed. The patient should place himself in a comfortable position, with a basin under the penis, and hold the solution in the urethra from ten to twenty minutes by the watch, allowing a little to escape now and then to medicate the part being pressed upon.

Argyrol should be freshly prepared at least once a week. Two grams ( $3\frac{1}{2}$ ) added to 60 c.c. ( $\S ii$ ) of water makes a solution of average strength and may be prepared by the patient; he should have a wide mouth 60 c.c. ( $\S iii$ ) bottle in which to keep the solution. The argyrol may be prescribed in well stoppered four gram ( $\S i$ ) vials to prevent dequescence. If the patient objects to this slight additional trouble in preparing it, almost as good results will follow if 180 c.c. ( $\S vi$ ) of a 5% solution is prepared by the druggist and thus used as an injection.

Protargol in  $\frac{1}{4}\%$  to  $\frac{1}{2}\%$  solutions may be substituted for argyrol if so desired. Argentide (silver iodide) is a silver salt which does not stain and in a 2% solution is useful in allaying the inflammation. Cargentos may be used in  $\frac{1}{2}$  to 2% solution, or albargin in  $\frac{1}{2}\%$  solution.

After the discharge has become thin and watery, the shreds lighter and the urine nearly clear, astringent injections should be administered two or three times daily. The following prescriptions may be taken as a type of the astringent preparations:

R Zinc. sulphat.  
 Plumbi acetat. ----- a. a. 1.3 gr. xx  
 Fl. ext. hydrast. (colorless) ----- 15. ʒss  
 Aquae dest. ----- q. s. ad. 180. ʒvi  
 M. Sig.: Shake and use as injection.

Or

R Zinc. sulphat.  
 Alum. ----- a. a. 1.3 gr. xx  
 Aquae ----- 180. ʒvi  
 M. Sig.: Use as an injection.

INTERNAL MEDICATION.—Oil of sandalwood (m. 5 to 10), balsam copaiba (m. 5 to 10) and oleoresin of cubebs (m. 5 to 10), are the most important of the anti-bleorrhagic drugs, and are of value when used in conjunction with the other measures. Pain is sometimes produced in the region of the kidneys by oil of sandalwood and indicates that it should be discontinued for a few days and then administered in smaller doses. Balsam Copaiba also causes an urticarial rash, and the patient should be advised to stop the capsules if this occurs.

Hyperacidity of the urine may be overcome by the drinking of large quantities of fluid, but where this seems not sufficient, the following may be prescribed:

R Potass. acetat. ----- 30. ʒi  
 Tr. hyocyami  
 Syr. aurantii cort. ----- a. a. 15. ʒss  
 Aquae ----- q. s. ad. 180. ʒvi

M. Sig.: Two drachms, four times daily, after meals and at bed time.

In dispensary practice a favorite substitute for the capsules of balsam copaiba, oil of sandalwood, etc., is LaFayette's Mixture.

R Balsam capaibae  
 Spir. lavand. comp.  
 Spir. ether nitros. ----- a. a. 15. ℥ss  
 Liquor potassae ----- 2. ℥ss  
 Ol. gualtheriae ----- 8. ℥ii  
 Mucil acaciae ----- q. s. ad 120. ℥iv  
 M. Sig.: Two drachms after each meal.

Hexamethylamine tetramine (urotropin, cystogen, hexamine, etc.) in  $\frac{1}{2}$  gram ( $7\frac{1}{2}$  grains) doses four times daily, dissolved in a glass of water seems of prophylactic value by tending to check the extension of the inflammation into the bladder. (A genuine gonorrhoeal cystitis, however, is very unusual.)

TREATMENT OF COMPLICATIONS OF ANTERIOR URETHRITIS.—Chordee or painful erections are the most annoying symptoms of the stationary period and sometimes cannot be entirely overcome, but if the foregoing treatment has been carried out from the beginning, and the patient sleeps on his side in a cool room on a hard bed and avoids allowing the bladder to become distended, these can usually be controlled so that only a slight amount of pain will be produced. To avoid a full bladder during the sleeping hours, the patient should not take much water or liquids for several hours before retiring, and may provide himself with an alarm clock to awaken him about an hour before the usual time for the erection in order that the bladder may be emptied. The patient should avoid lascivious thoughts and never eat heavy meals at night. If, in spite of these precautions chordee occurs, the penis should be immediately immersed in cold water or be placed against some cold object. The "cord" should never be broken, as a stricture is almost certain to follow.

Bromide of potassium or sodium in doses of 30 to 40 grains may be given at bed time. Ergotole in 5 to 10 minim doses on

retiring lessens the number of erections. If chordee should be unusually severe and does not respond to these simple measures, an ice bag should be placed over the external genitals.

PHIMOSIS AND PARAPHIMOSIS.—Phimosis is a narrowing of the foreskin so that it cannot be retracted. This condition not infrequently develops if the inflammatory process is acute, and considerable edematous swelling is present. If the foreskin is retracted and this swelling occurs, it is called paraphimosis. Both of these conditions, as a rule, readily respond to vaccines, pressure, and ice water. Rarely will the constricting band of a paraphimosis require incising if seen early and a bandage be so applied that firm pressure is exerted on the edematous foreskin and glans penis anterior to the constriction. This does not apply to the long standing conditions where gangrene has already begun or where the penis is excessively tender. In such instances the constricting band should be incised, care being taken not to mistake a fold or false constriction for the real constricting band. Two or three applications of the bandage usually render the retraction possible in four to twenty hours. If this plan seems inexpedient or the bandages cannot be satisfactorily applied, manual pressure of the penis, which has been wrapped in a towel wet with ice water, may reduce the swelling. It seems hardly worth while saying that the pressure should be so exerted as to squeeze the edematous fluid from the part anterior to the constriction into the penis and not in such a manner as to increase the swelling. If the bandage has been properly applied, the penis, bandage and all may be soaked in ice water to advantage.

Large doses of mixed gonococcic vaccine are often of signal value when there is swelling of the foreskin. (See chapter on Vaccine Therapy.)



FOLLICULITIS AND PERI-URETHRAL ABSCESS.—During the acute stage small, round tumors about the size of a pea may develop along the urethra from extension of the inflammation into the follicles. These may gradually undergo resolution and disappear entirely, or they may increase in size and suppurate. If the latter condition obtains, the abscess should be incised and drained until healing from the bottom of the cavity has occurred. An abscess here rarely ruptures into the urethra.

BALANITIS is an inflammation of the surface of the glans penis, and occurs during gonorrhoea as a result of uncleanness, or prolonged contact with the irritating discharges. If the inflammation extends to the prepuce it is called balanoposthitis. These conditions readily respond to treatment and are of little consequence unless phimosis exists or develops so as to interfere with the cleansing. The sub-prepuceal space should be irrigated once daily with a saturated boric acid or a weak permanganate solution. In the meantime, a 10 per cent. solution of argyrol should be injected every three or four hours, and retained under the foreskin for five minutes. Bismuth subnitrate one part mixed with liquid albolene five parts injected under the foreskin three or four times daily, affords a very soothing application. The skin surface of the prepuce may be covered with cotton, soaked in a saturated solution of aluminum acetate to lessen the swelling.

LYMPHANGITIS is an inflammation of the dorsal lymphatic vessels. It rarely gives much trouble, but should be treated with local applications of tincture of iodine or ichthyol once or twice daily.

INGUINAL ADENITIS OR BUBO is an inflammation of the lymphatic glands of the groin, usually brought on during the

stationary or subsiding stage by long continued standing, exertion, exposure or excess. The patient should be placed in bed and the skin over and well around the inflamed gland painted with tincture of iodine. An ointment of equal parts of lanolin and ichthyol should then be applied; over this may be placed abundant cotton and a tight spica bandage so as to produce uniform pressure. If suppuration occurs, the bubo should be incised and drained as described under chancroidal bubo.

SUMMARY.—The treatment of gonorrhoea requires a well ordered, temperate life with moderation in eating and exercise. Sexual excitement and sexual intercourse should be absolutely forbidden. The patient should drink large quantities of plain water, lithia water, limeade and buttermilk, so as to provide bland unirritating urine to flush the urethral canal at frequent intervals. If seen very early, 25 minims of a 5% solution of argyrol should be sealed in the urethra with collodion once daily for five days. It should be held in the canal at least six hours each day, but the treatment should be discontinued at once if the discharge continues or if the urine remains cloudy after two or three sealing-in treatments. When this fails or seems inexpedient on account of the extensive or severe inflammation the injection of 5% argyrol,  $\frac{1}{4}$ % protargol,  $\frac{1}{2}$ % albargin, 2% agentide, or 2% cargentos should be administered three or four times daily, and irrigations of potassium permanganate 1 to 8,000 in a physiologic salt solution should be given, in addition to the injections, once or twice daily. Oil of sandalwood should be given in 5 minim doses after each meal and at bedtime.

## CHAPTER III

## DEEP URETHRITIS AND CHRONIC GONORRHOEA.

SYMPTOMS, PROGNOSIS, TREATMENT OF ACUTE POSTERIOR URETHRITIS, COWPERITIS, CHRONIC GONORRHOEA AND GLEET, VARIETIES, CAUSE OF CHRONIC URETHRITIS, PATHOLOGY OF CHRONIC GONORRHOEAL URETHRITIS, SYMPTOMS, DIAGNOSIS, PROGNOSIS, TREATMENT, INJECTIONS, IRRIGATIONS, MEDICATED OIL, INSTILLATIONS AND SUMMARY

Involvement of the deep urethra may occur without symptoms to suggest inflammation of this part of the canal. If the anterior urethra is irrigated and the patient is allowed to urinate into two glasses, the first will be cloudy while the second will be clear, if the inflammation has not extended to the bladder. The prostate and seminal vesicles frequently become infected insidiously, from the mild conditions, and may not be suspected until the persistency of the discharge, pus and shreds, or recurrences lead to a more thorough examination.

This variety of posterior urethritis is of more common occurrence, but is less frequently diagnosed than is the severe form with well marked urinary symptoms such as strangury and cloudiness in the second glass of urine. The desire to urinate is very frequent and urgent, and urination is attended with considerable pain, especially at the end of the act and for some time thereafter. A sensation as if the bladder had not been completely emptied may occur, and occasionally the last few drops of urine will be tinged with blood, squeezed from the deep urethra by the contractions of the muscles surrounding it. The discharge from the meatus may be diminished or it may stop completely, but it returns after the acute condition

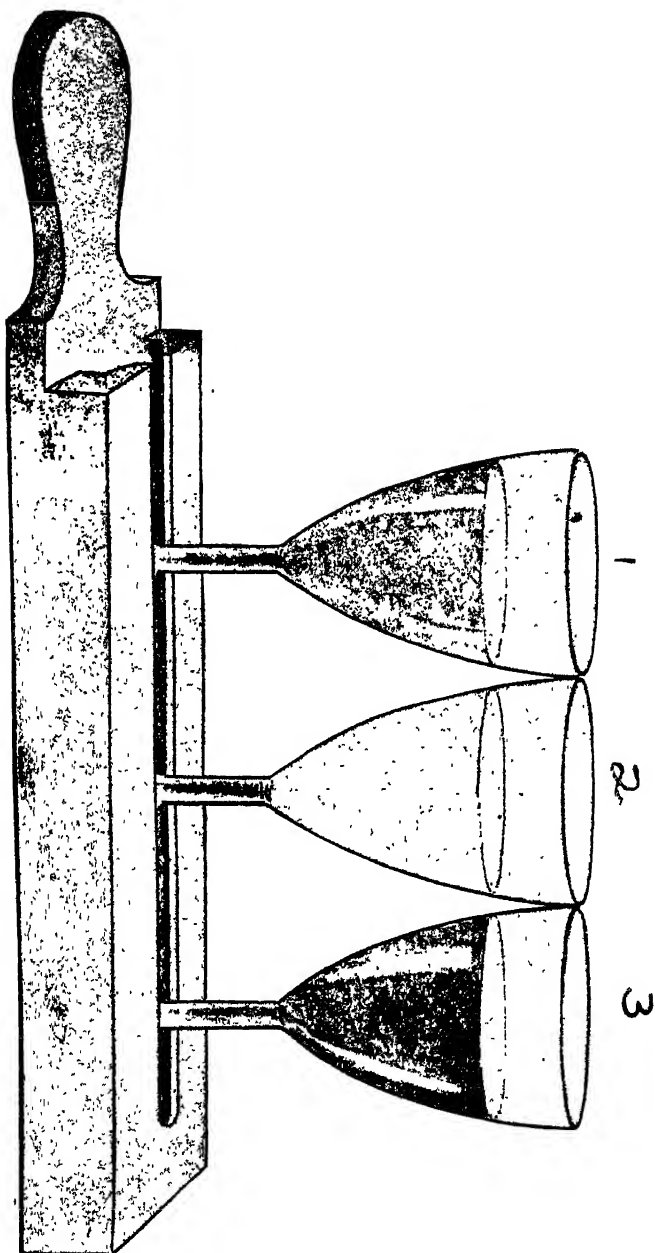


Figure 10.—Urethro-Cystitis.—All Three Glasses Cloudy—More Pus in First and Third Glasses.

in the deep urethra, prostate, seminal vesicle or epididymis has improved. The second glass of urine contains pus when the secretion is of sufficient quantity to flow back through the internal sphincter into the bladder. The musculus compressor partis membranous urethrae is the muscle shutting off the anterior urethra from the posterior, and pus secreted behind it does not appear as a discharge, but is seen in the urine, more cloudiness being in the first glass than in the second and third, for the first has the washings of the urethra in addition to the pus which has passed back into the bladder. Just the reverse is true in cystitis, the third glass being more turbid than the first. Pus present in the third glass, after the urine has been retained for some time, and absent when it has been held only a short time, is clearly indicative of a deep urethritis, and also eliminates suspicion of cystitis. In case there is doubt, the anterior irrigation, with subsequent passage of urine in two glasses, will readily clear up the situation.

Prostatitis, seminal vesiculitis, and epididymitis are more likely to occur when there is inflammation in this part of the canal on account of the numerous ducts opening into it. Sexual intercourse, sexual excitement, even when ungratified, muscular exertion or straining, the passage of instruments into the urethra or injury of the epididymis and testicle or perineum tend to cause these inflammations.

PROGNOSIS OF POSTERIOR URETHRITIS.—Under rational treatment the prognosis is good as regards the acute symptoms, but on account of the likelihood of involvement of the prostate and bladder it should always be remembered that it may pursue a prolonged course, with or without acute inflammation of these organs.

TREATMENT OF ACUTE POSTERIOR URETHRITIS.—When the inflammation is mild, little change need be made in the treatment as already given, except to coax the sphincter to re-

lax and allow the irrigations of permanganate to pass into the bladder, which is filled and then emptied. This should be repeated until there is a slight burning, or until one or two quarts of solution are used up.

In severe posterior urethritis with frequent painful urination and tenesmus, rest is of great importance. All local treatment should be discontinued, and dependence placed upon diluent drinks, internal medication and rest in bed. Urotropin in 5 to 10 grain doses, four or five times daily, should be added to the remedies given internally. This liberates formaldehyde in the urine, and lessens the development of gonococci in the bladder. If the urine is very acid, this remedy may increase the pain and frequency in urinating and in such cases should be administered with lithia. After the very acute symptoms have subsided boric-carbolic irrigations should be resumed.

If the patient makes a straining effort as if trying to expel the last few drops of urine from the bladder, the fluid can be made to pass into the bladder in the majority of instances without force, or harmful distention of the anterior urethra. This method is attended with less pain, difficulty and danger of complications than are the irrigations with a catheter. If acute prostatitis or vesiculitis exist, hot rectal irrigations of two quarts of physiologic salt solution once or twice daily will be beneficial, where they can be administered without effort or exertion on the part of the patient. Hot sitz baths are also of value and may be taken once or twice daily. For the tenesmus and pain the following suppository may be prescribed:

R	Morphin. sulphat. --	.005 to .01	gr. 1-12 to 1-6
	Ext. belladonnae -----	.015	gr. 1-4
	Ext. hyocyami -----	.03	gr. ss
	Camph. monobrom. -----	.3	gr. v
	Ol. theobromat. qs.		

M. et ft, suppository, No. 1.

Sig.: Introduce one such suppository into the rectum every 5 to 8 hours as needed.

COWPERITIS.—This is rather a rare complication, and is an extension of the inflammation to the glands of Cowper, which lie between the triangular ligaments beneath the symphysis pubis on either side of the urethra. In the beginning a small tender nodule is found on one or both sides; later, there is swelling, pain, throbbing and feeling of tension. An abscess may develop and usually requires incision.

### CHRONIC GONORRHOEA AND GLEET.

It is a well known fact that the terms chronic gonorrhoea and gleet are not synonymous; for gleet, which is a slight watery or mucopurulent discharge, may exist when persistent search fails to show gonococci, while on the other hand, chronic gonorrhoea may not be attended by any discharge from the meatus. Dr. A. F. Toole found from an analysis of the assertions and suppositions of four of the best known American authors as to the cause of the "morning drop" or discharge that there were 45 separate and distinct causative factors, the presence of any one of which is assumed to be sufficient to produce this morbid moisture. Of these, 10 were acknowledged as sequelae of gonorrhoea; 9 were non-gonorrhoeal conditions of the genito-urinary tract; 12 were called habit or invironment disease, while 14 constitutional disorders are said to be frequently complicated by this annoying symptom. The various treatments were found as complex and numerous as the causes of this ailment. Of all the etiological factors and the different remedial measures suggested, our attention is to be devoted to only a limited number of the most important causes.

VARIETIES.—The varieties of chronic urethritis as given by Lydston are:

(1) The subacute conditions that cause pain and discomfort on urinating and with frequent exacerbations, the prostate

often being involved with a feeling of fullness in the perineum and the other symptoms which accompany it.

(2) The thin watery discharge, perhaps only evident in the morning and without discomfort. This class is more frequent than the first, and depends upon (a) a simple catarrhal condition of the mucous membrane from systemic trouble, (b) congested and granular patches; (c) organic stricture; (d) abscess or fistula; (e) dilation and chronic inflammation of the lacuna magna; (f) posterior urethritis; (g) folliculitis; (h) Cowperitis; (i) tuberculosis, which may be engrafted upon a chronic gonorrheal urethritis.

(3) Conditions apparently cured, but in which sexual excess, intemperance, etc., set up a mucopurulent discharge.

THE CAUSE OF CHRONIC URETHRITIS.—In the large majority of patients the causes of chronic urethritis are prostatitis, seminal vesiculitis, inefficient treatment and excesses during the acute attack or the convalescent period.

The inflammation is usually "side-tracked" or "pocketed" in depressions where the organisms are protected from the urinary stream as well as from urethral irrigations or injections. Here the gonococci lurk ready to increase their virulence at the proper stimulus or when the immune antibodies become less active.

These recrudescences, after a period of quiescence more or less complete, are usually caused by alcoholic excesses, sexual excitement, lowered resistance on the part of the host or local injury, chemical or mechanical. As a rule they run a milder course and the acute period is of shorter duration than was the primary acute attack.

The toxins secreted by gonococci in the protected recesses, glands and follicles may pass out into the urethra and keep up a recurrent or a persistent discharge, and yet difficulty may be



experienced in demonstrating their presence. Granular patches and points of congestion as well as the narrowing of a stricture and the inflammation behind it may keep up the discharge. Normal narrowings in the urethral canal and cachectic conditions of any kind, as tuberculosis, syphilis, diabetes, Bright's disease, rheumatism, etc., act as predisposing causes. The gonococci usually disappear after 2 or 3 years and are rarely active unless there are frequent recurrences. The mild chronic inflammation is kept up quite frequently by colon bacilli, staphylococci, and other organisms left in the wake of the gonococci.

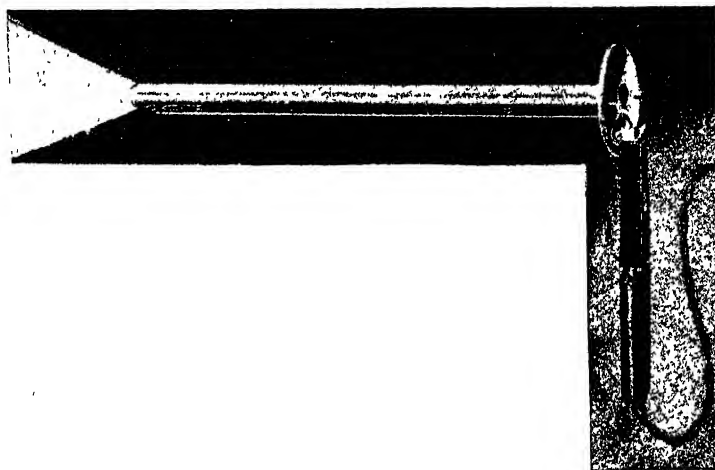


Figure 11.—Cold Lamp Urethroscope.

**PATHOLOGY OF CHRONIC GONORRHOEAL URETHRITIS.**—The lesions are usually some form of infiltration and thickening in the mucous or submucous tissue. This is more likely to occur around the follicles and depressions. The mucosa over these areas of thickening may be congested or granular looking. The epithelium of the urethra proliferates and degenerates, the cylindric form changing to the squamous. The favorite seats for such lesions are the posterior urethra and the bulb. The in-

flammatory process may be limited to the anterior or the posterior urethra, but as a rule it involves both. The prostate and seminal vesicles are nearly always affected.

**SYMPTOMS OF CHRONIC ANTERIOR URETHRITIS.**—There is usually redness around the meatus and slight burning may be felt on urination. A slight discharge of mucus or mucopus is generally present, but may be of so small a quantity that it is seen only as the "morning drop." There may be nothing but a stickiness at the meatus. The discharge appears thin and watery, or whitish in color, until an exacerbation is brought on and it becomes more profuse, yellow and thick, clouding the urine. Microscopically the discharge now shows large numbers of pus cells, desquamated epithelial cells, intracellular gonococci, and other organisms in varying numbers. Shreds are invariably present in the urine, and are usually in proportion to the inflammation, and their decrease and final absence is a much better index of the progress and cure of the disease than is the discharge, for they persist long after the discharge has ceased. The shreds are analogous to the mucus which may collect in the nasal cavities; their character varies from pure mucous shreds which appear clear in color, often long, and float near the surface, to purulent ones which readily sink to the bottom. Under the microscope the latter show mucus, pus cells, epithelia, gonococci, and other organisms. The shreds are of considerable value in determining the stage of the process, and the order of their appearance is, with certain reservations, as follows: Pus shreds, mucopus shreds, mucous shreds, and epithelial shreds. (Saxe.)

**THE SYMPTOMS OF CHRONIC POSTERIOR URETHRITIS.**—The symptoms unfortunately are more or less vague and indefinite in mild cases, and are for that reason most likely to carry infection to innocent parties. If the urethritis is located chiefly

in the deeper part of the canal there may be no discharge, not even a "morning drop" to warn the patient of the danger.

There is nearly always a history of recurring discharge of a varying degree of intensity, from a mild acute attack to a mere drop. These recrudescences are likely to be set up by alcoholic and especially by venereal excesses, the patient frequently thinking that he has contracted a new infection.

There may or may not be frequency of micturition, which is in proportion to the urethro-cystitis. There may be pain in starting or completing the act of urination. If there is an acute exacerbation and the inflammation is marked, a drop of blood may be squeezed out of the congested verumontanum by the muscular contraction.

The involvement of the sexual function is variable. As a rule, though not always, it is proportionate to the depth of the inflammatory process and the extent to which the prostate is involved. Ejaculations may be either premature or unduly prolonged or attended with pain. The normal sensation may be lost or altered. So extensive is the nervous connection of the deep urethra and so depressing and widespread are some of the symptoms that it may be well considered the "solar plexus" of the pelvis. Pain may be felt in the lumbar or sacral region, down the thighs, above the symphysis pubis, or back toward the rectum. These pains may be mild and intermittent or neuralgic in character and usually mean that the prostate also is inflamed.

Mental depression and neurasthenia are frequently seen, especially if nocturnal emissions are frequent. Indigestion, constipation, disturbance of the general health with a loss of weight are found in certain cases.

**DIAGNOSIS.**—The histories of these cases are usually characteristic; shreds are always in the urine; a slight discharge if the anterior urethra is involved; no discharge if limited to the deep

urethra, but recurrences may result from alcoholic or venereal excess when the patient thinks he is well. The discharge and shreds should be stained and examined microscopically for gonococci. In reaching a diagnosis the surgeon should not only locate the trouble, but determine, if possible, the cause of its persistence, as an urethral constriction, inflammation of the prostate or any adjacent structures. The anterior urethra should be irrigated with a physiologic salt solution, part of the urine then being passed into two glasses. The prostate now should be massaged, as well as the seminal vesicles and Cowper's glands and the remainder of the urine passed into two glasses. (Those held in a grooved block with their rims in close apposition to facilitate the collection of the urine in several portions, are preferred.) If the anterior urethra alone is involved, the urine voided immediately after the irrigation will contain no shreds, but if the deep urethra is affected the first glass will contain pus and shreds. Shreds, pus, and albumose in the urine after massage indicate prostatic involvement. A bulbous bougie should be passed and any constrictions, tender points, or other abnormalities noted. If the discharge has been persistent, and ordinary treatment has failed, the canal should be explored with the urethroscope and a search made for congested or granular patches and infected follicles. A complete examination should not be made at a single visit on account of the danger of aggravating the symptoms or producing an acute attack, nor should instrumental examination be made if sexual intercourse has been indulged in recently, as localized beginning infection may be spread deeply and rendered more difficult to cure than it otherwise would have been.

THE PROGNOSIS.—The time required to cure chronic urethritis usually varies with its duration and the extent of the complications. It is well never to promise to cure a patient in any given time, as there are so many factors under the

patient's control that may not be properly carried out. The average time required for the cure of an uncomplicated urethritis is from 3 to 10 weeks. Occasionally, however, there will be found intractable cases, disappointing to both the surgeon and the patient.

If stricture is beginning to form or is the actual cause of the discharge, the prognosis depends upon whether or not the surgeon adopts a plan of treatment that will cause absorption of the inflammatory exudate while it is recent and soft. If it has undergone complete organization the prognosis, as to the discharge, is altered and depends upon the curability and complications of the stricture. The modern treatment of gonorrhoea rarely causes or permits the formation of urethral strictures which are now seen much less frequently than formerly.

If the deep urethra is involved all the factors in the case must be considered, as the age, general health and complications, as prostatitis, vesiculitis, cystitis, condition of the kidneys and ureters. Dissipation excesses or irregular treatment will always prevent satisfactory results. Dr. Geo. R. Livermore has observed that deleterious effects follow the administration of quinine to patients suffering from either acute or chronic gonorrhoea, and if it is given for any length of time it renders the disease intractable.

**TREATMENT.**—No routine treatment can be used with these patients, but it must be selected after a careful examination of the anterior and posterior urethra and a consideration of the previous history and treatment. The social condition, habits of the patient, and his general health must all be considered.

Fresh air, moderate exercise, nourishing but non-stimulating food, and plenty of plain or lithia water are essential. If the patient has been overtreated the discharge will often cease if all treatment be stopped and the digestion and urethra allowed to become normal.

Alcoholic, carbonated, and caffeine drinks are to be forbidden. Sexual excitement and sexual intercourse are always harmful. The bowels should be regulated by aperient waters, magnesium sulphate, cascara, lapactic or c. c. pills, or sodium phosphate, as preferred or found to be most effectual. Hot enemas are beneficial in certain cases, especially when there is a tendency to an irritable condition of the bladder, and especially if they are used in conjunction with hot sitz baths. Balsam copaiba and oil of sandalwood should be given in 5 m. doses of each three or four times daily.

INJECTIONS.—Mild uncomplicated chronic cases may be started upon weak astringent injections. As to the strength of the solution, it is desirable in most cases to produce a warm prickling sensation, but never a positive pain. It is only by the abuse of injections that harm results, for properly used they are very valuable in the treatment of gonorrhoea, both acute and chronic. They should be given two to four times daily and the meatus held together when the syringe is removed and the fluid retained for five to ten minutes. Among the most useful astringent solutions may be mentioned zinc sulphate 0.30 gm. (5 gr.) to 30 c.c. (1 ounce) of water; lead acetate 0.30 gr. (5 gr.) to 30 c.c. (1 ounce) of water, or hydrastin muriate 0.30 gr. (5 gr.) to 30 cc. (1 ounce) of water. The strength of these should be increased gradually and the patient instructed always to dilute any injection that produces pain. These remedies may be combined with advantage as in the prescription suggested for the subsiding stage of acute gonorrhoea.

IRRIGATIONS.—In addition to this treatment, irrigations may be given advantageously and permanganate of potash 1-8000, boric-carbolic as previously described, and nitrate of silver 1-8000 are the most useful remedies at this stage. The irrigations should be given daily, as hot as the patient can

bear comfortably, and the strength increased gradually until slight burning is felt after the treatment. The intervals between treatments should be lengthened as the condition improves. As the prostatic urethra nearly always is involved the patient should make an effort to urinate or to force out the last few drops of urine and in this way relax the constrictor muscle and allow the fluid to pass back into the bladder. The fluid thus medicates the urethra both going in and coming out, and the process should be continued until the bladder has been filled from two to four times, according to the burning caused. If after 8 to 10 weeks of injections, irrigations and vaccine therapy there are still evidences of urethritis, more active measures may be adopted. One of the simple and effective methods is the injection of medicated oil into the urethra where it is held by pressure on the meatus until it can be followed by a steel sound to carry it into the folds and the deep urethra. (Neither this nor any instrumental treatment is indicated as long as gonococci can be detected in the secretion or shreds.)

**MEDICATED OIL.**—The most satisfactory preparation we have used for this purpose is "medium lubricating oil" such as is used for automobiles, in each ounce of which 2 to 5 grains of nitrate of silver may be dissolved. This is thicker than liquid albolene and thinner than vaseline. Ten c.c. of this injected into the urethra, with an ordinary syringe, facilitates the passage of a sound or Kollmann dilator, lubricating and at the same time medicating the urethra. (When needed, cocaine may be applied in the same manner as it is soluble in this oil.)

The passage of the sound makes a thorough application of the medicine and at the same time stretches the urethra, with a minimum of friction and irritation.

In case the deep urethra is involved and the oil does not pass the constrictor urethrae muscle, the medicine may be in-

jected by using a sharp pointed syringe and attaching it to a soft catheter cut down to 8 inches in length; the medicine can be deposited both in the anterior and posterior urethra and a sound then passed. These treatments may be repeated every second to every seventh day according to the reaction which follows.

The urethra may be massaged gently along the sound to express the secretion from the follicles and to force into them a small quantity of the oil. The pressure of the sound, in addition to the massage, has a beneficial effect on the absorption of the exudate beneath the mucous membrane and around the inflamed follicles.

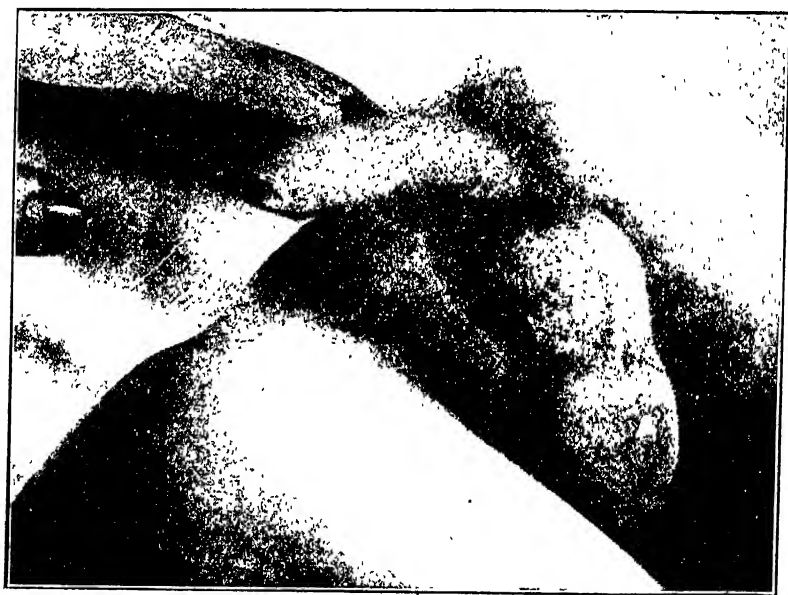


Figure 12.—Abscess of Cowper's Gland.

If the symptoms do not yield, an endoscopic examination should be made and congested and granular patches touched every 3 to 4 days with 1% to 5% watery solution of



silver nitrate, with a small pledget of cotton tightly twisted on an applicator.

When the deep urethra is involved cold sounds are useful to allay the irritability of the verumontanum and prostate. Here good is derived from an ointment of lanolin 30 gm. (1 ounce), glycerine 30 gm. (1 ounce), containing 0.3 gm. to 0.6 gm. (5 gr. to 10 gr.) silver nitrate, deposited in the posterior urethra every few days with a Tomasoli ointment carrier.

A valuable remedy in this region is the instillation of 1% to 3% solution of silver nitrate in water by means of a long curved syringe, or a soft catheter attached to a syringe, 2 m. to 4 m. being injected just beyond the compressor urethrae muscle. The bladder should contain a small quantity of urine to neutralize the nitrate of silver that escapes into it. All the symptoms are made worse for a time by the chemical irritation and the patient has a frequent desire to urinate for 3 to 6 hours; but when the condition subsides some of the chronic inflammatory products are absorbed, and by a succession of instillations the parts finally become normal.

Success in curing these patients depends upon discovering all the complications as prostatitis and vesiculitis and upon properly treating them with the urethritis, by the application of vaccine therapy to be described in the next chapter.

**SUMMARY.**—The posterior urethra is involved by the inflammatory process to more or less extent in nearly all urethritides of more than a week or ten days' duration. This is shown by the presence of pus and shreds in the urine voided after irrigating the anterior urethra. The mild inflammation may be attended by no symptoms that lead the patient to suspect the extension of the infection to the deep urethra. When the inflammation is severe the patient has a frequent and an urgent desire to urinate. The treatment consists of the routine measures previously described and irrigation of the entire ure-

thra and bladder. Physical rest is important as complications such as epididymitis, prostatitis, vesiculitis may arise. The general regulations previously mentioned in the management of gonorrhoea should be rigidly followed. Hot sitz baths and hot rectal irrigations are indicated.

Chronic gonorrhoea is usually due to inefficient treatment on the part of the physician or patient, or to the extension of the inflammation to the prostate, seminal vesicles, Cowper's glands or urethral follicles. Attention to these complications, in addition to a correction of the habits and diet, with daily irrigations of potassium permanganate or nitrate of silver in weak solutions, and injections of astringents as zinc sulphate and lead acetate will usually effect a cure. Vaccine therapy also affords a valuable aid. If in spite of these measures the inflammation persists endoscopic applications of silver nitrate in 2% to 5% solutions or instillation of solutions of about one-half these strengths should be resorted to. Patience, persistence and gentleness are required of the surgeon and faithfulness and good behavior of the patient.

## CHAPTER IV

## VACCINE OR BACTERIN THERAPY

LOCAL CONDITIONS, AUTO-INOCULATIONS, SITE OF INJECTIONS,  
CAUSES OF FAILURE, IMMUNITY BALANCE, MIXED INFECTION,  
OTHER MEASURES NECESSARY, MILD PROSTATIC INFECTIONS,  
DOSAGE OF VACCINES, OPSONIC INDEX,  
PHYLACOGENS, AND SUMMARY.

TREATMENT WITH "BACTERINS" OR "VACCINES."—Almroth F. Wright, of London, demonstrated that the power of leukocytes to incorporate and destroy micro-organisms was dependent upon substances in the blood to which he gave the name "opsonins," (from the Greek word meaning, "I prepare food for"). He also found that phagocytosis could be increased by injecting subcutaneously small doses of killed germs of the same kind as those producing the infection. By making the injections at appropriate times and in suitable amounts the patient's resistance to the particular disease produced by these germs can be increased.

The "opsonic index" is the measure of the power of the blood serum of an infected individual to prepare bacteria for ingestion compared with the serum of a healthy person.

When a dose of bacteria is administered there is first a sinking of the opsonic index, which is designated the "negative phase." Within a short time this is followed by an increase in the bacteriotropic power called the "positive phase." If an average dose of bacterin is injected the "negative phase" will not be attended with any clinical symptoms. During the "positive phase," however, the patient observes a general improvement, proportionate to the amount of the antibodies produced.

The object we have in view is to maintain the increased resisting power by injections repeated at proper intervals.

LOCAL CONDITIONS.—What seems to more than equal in value the determination of the opsonic index is the promotion of a free flow of bacteriotropic serum by appropriate treatment. Wright has shown that the foci in which bacteria cultivate themselves are deficient in antibacterial substances on account of the sluggish circulation and the clotting of lymph in the sinuses. The same condition of lowered opsonic index exists in the effusions of serous membranes. Consequently the effusion of infected cavities should be tapped in order that this fluid of low bacteriotropic power be replaced by active serum fresh from the circulation. A similar condition exists in abscesses and sinuses, and in addition there is the disintegration of the leukocytes with the liberation of a tryptic ferment. Wright calls particular attention to the paralytic action thus brought to bear sooner or later on the leukocytes in every focus of suppuration, and to the futility of attempting to cure the old suppurating cavities by vaccine therapy, unless the tissues are securely guarded from the digestive action of the pus and are flooded with opsonic fluid fresh from the circulating blood. These facts are particularly illuminating when considered with the conditions existing in the inflamed prostate. Here we note the effect of the ferments liberated by the leukocytes, the proteids being promptly converted into albumose, a substance which we have found to be present constantly when the gland is inflamed, and to be of distinct value in the diagnosis of such conditions. A correlation of these points readily shows that our treatment by prostatic massage has underlying it curative factors of which we were formerly unaware. We knew it benefitted the patient but did not know why. Some of the value of the treatment by urethral irrigations in urethritis is perhaps due to the cleansing action and the slight hyperemia which follows the flushing of the canal with hot solutions and which brings a more liberal amount of opsonins into the inflamed tissue.

To remove the obstacles to the free streaming of lymph through a focus of infection, Wright introduces into every dry sinus a 0.5 per cent. solution of citrate of soda and 10 per cent. sugar. This may be supplemented when necessary by dry cupping. The citrate of soda prevents coagulation and scabbing by decalcifying the lymph, and the sugar causes fluid to transude from the blood vessels by osmosis. This should be remembered in treating sinuses or persistent suppuration of broken down buboes. Occasionally adenitis will be encountered in which "brawny swelling" is quite marked and yet an incision may not show pus or very much serous exudation. In such conditions Wright thus established a free transudation of lymph by administering 4 gram doses of citric acid every six to twelve hours for two or three days.

**AUTOINOCULATIONS.**—The question of autoinoculation is an important one and throws still further light upon the cause of the beneficial result of prostatic massage. Freeman, working with Wright in St. Mary's Hospital, has made a systematic study of the conditions under which autoinoculations can be produced in persons affected with localized bacterial infections. He was able to show that autoinoculations follow all active and passive manipulations which affect a focus of infection and all vascular changes which stimulate the lymph stream in such a focus. As the extent of this inoculation cannot be known, massage of the prostate or manipulation of gonococcal joints should not be used at the time of injecting the vaccine lest an over dose may thus be thrown into the system.

In cystitis we must administer irrigations, and urotropin to destroy the organisms in the urine, for here they cannot be reached by the opsonins.

**SITE OF INJECTIONS.**—It is claimed that the anti-bacterial substances are probably manufactured locally in the tissues at

the site of the injection. It is obvious then that the bacteria should be so placed when possible that the bacteriotropic serum will pass through the infected focus before entering the general circulation. In case of inguinal adenitis the injection should be made in the upper third of the anterior portion of the thigh. With urethritis our impression is that the opsonins must reach the general circulation first and consequently we inject the vaccine into the buttock, as there a minimum amount of pain is produced.

CAUSES OF FAILURE.— The literature concerning the treatment of gonorrhoea with bacterins shows many conflicting reports and inconclusive evidence as to beneficial effect. The practical results vary from almost miraculous cures to totally negative effects. The reason for this is at first not clear to the physician using the bacterins, nor indeed to one studying the reports of many clinicians. But if we observe the numerous unknown and uncontrollable factors playing important parts in the cure of gonorrhoea, we need not wonder at this lack of uniformity. The personal equation is highly important, because no matter how exact the bacterin may be, the production of antibodies must be considerable to effect immunization to these organisms, since without immunization it is impossible to cure any well-established gonococcic infection.

The ability of the body to react and to produce antibodies varies greatly from time to time; furthermore, according to the activity of the disease, our experience is that the greater the systemic reaction and the deeper and more active the infection, the more prompt and reliable the results. This holds true both in the intense recrudescences of long-standing disease and in acute gonorrhoea recently acquired with much discharge and swelling of the tissues. The cure of gonorrhoeal rheumatism may be regarded as further evidence of the importance of systematic reaction.

**IMMUNITY BALANCE.**—These facts in connection with the course and cure of gonorrhea indicate that the immunity-balance is very delicate and that its slight changes may be attended with far-reaching beneficial or deleterious results. The utmost care should therefore be exercised to promote local health of the treated mucous membrane. This implies the use of non-irritating washes and injections, and, in urethritis, the frequent flushing outward of the canal with bland urine. Few factors are more important in the treatment than frequent urination as at each voiding the patient washes from the mucous surface perhaps millions of infecting organisms, which, if not thus frequently carried away would remain, and by the production of toxins, or otherwise, decrease the ability of the patient to combat the germs which are too deep in the mucosa to be washed out of the canal. If urination is once every three hours instead of every hour, there would of course be a greater amount of toxin present in the canal to intensify the inflammation. With this principle applied, a healthier condition and increase of the needed local resistance is insured, and when the protective substances circulating in the blood become available they may be utilized in curing the disease rather than in combatting the toxic effect of the germs upon the surface.

**MIXED INFECTION.**— Even the beginner in bacterin therapy must realize that success may not be expected unless the organisms injected are indetical with those causing the disease or its greater part, and yet at times we must feel doubtful as to the exact diagnosis. We know nonspecific urethritis is of frequent occurrence and that secondary infection with the ordinary pyogenic organisms plays an important part in acute, subacute, and chronic inflammations. The mere presence of organisms, however, does not mean that they are always active in causing the disease. In subacute and chronic inflamma-

tions, the secondary infections nearly always play an important part, and therefore we must guard against this danger.

A recent study of the micrococcus catarrhalis in genito-urinary infections, by Ayers, shows how difficult or impossible it may be, without a culture-test, to determine that a given infection inflammation is a true gonorrhoea. Ayers states that the demonstration of a Gram-negative diplococcus within the pus-cells of a discharge from the urethra is not proof positive of a gonococcic infection. He thinks that all such subacute inflammations should be regarded with suspicion; he admits that the micrococcus catarrhalis is not a germ of slight pathogenicity, and that it is capable of causing a dangerous inflammation. We thus see how easy it is to make an error even when careful microscopic examinations are made, and that the wrong bacterin may be employed, with demonstration of its worthlessness.

OTHER MEASURES NECESSARY.—By this general discussion of some phases of the subject we have tried to show that more is required of the physician than a mere injection of the vaccine, even when he is reasonably certain that it contains the proper organisms. When there is failure to obtain a satisfactory result, he should carefully consider every possible condition to determine the weak link in the chain of the desired immunity.

Nothing, as stated, but immunity to the gonococci or other infecting germs can cure the disease after the organisms have become well implanted. This may not seem apparent at first, but a moment's consideration of the conditions must impress one with the absolute necessity of such immunity before a cure is possible. Our duty is therefore to busy ourselves with the measures that promote a healthy local condition and to increase the bodily immunity to such a degree that the infected



region exhibits a resistance sufficient to win the fight against the invading organisms. Of all the factors that lessen the local urethral resistance there is none, we are convinced, that is more pernicious than is urethral instrumentation, or "sounding" in gonorrhoea. Bacterins should be used as a valuable adjunct to other useful measures in the treatment of gonorrhoea, but should not be allowed to supplant general treatment to be continued for several weeks after the cure seems complete; otherwise a recurrence may develop. Alcoholic and venereal indulgences should continue to be forbidden until ready to test the cure.

MILD PROSTATIC INFECTIONS.—We think that patience, gentleness, and care, on the part of the physician and regularity and good behavior on the part of the patient will ultimately be rewarded by a cure without possible relapse, and even in the stubborn cases. This statement, however, does not hold good as regards the mild infections with colon bacilli, staphylococci, and other organisms frequently left in the wake of gonorrhoea and which may resist every form of treatment. In the mild infections of the prostate, without the presence of pus and without discharge, vaccine seems worthless, because no reaction occurs, and it is just as impossible to destroy the germs as it would be to sterilize the mouth by the injection of bacterins. The patient's prostate has developed a "non-sterilizing immunity."

It will be noted that no pus is present and that the fresh secretion has the appearance of diluted milk. Elsewhere we have presented the theory that the prolonged growth of these attenuated organisms in the prostate gland produces a toxin which ultimately causes hypertrophy of this organ. While this view may not at present be proved or disproved, it seems supported by more facts and more collateral scientific evidence than any theory so far advanced.

As these attenuated organisms, in addition to those which cause mild chronic inflammation of the prostate and vesicles, are difficult or impossible to destroy when once well established, and as gonorrhoea or its treatment affords the most usual methods of infecting these parts secondarily, our feeling is that mixed vaccine should be used from the beginning so as to increase the natural defenses of the patient as early as possible, to tedious mild infections which play such an important role in these organs at this critical period, and to prevent the more troublesome chronic affections.

It is true that when gonorrhoea is contracted the patient may already have a mild infection of the prostate caused by continued masturbation, prolonged ungratified sexual excitement, previous urethritis, or anything that causes long-standing congestion of the prostate and sexual organs.

Staphylococcic infections respond more satisfactorily than any other to vaccine therapy, therefore it might be expected that prophylactic application of mixed vaccines early in gonorrhoea might prevent the late chronic infections with these organisms. Theoretical and clinical evidence has already indicated the expediency of this procedure whether or not one subscribes to the theory of prostatic hypertrophy, the object being to effect a complete cure so as to leave no trace of gonorrhoea or its after-effects. We therefore use the mixed Neisser-bacterin to inhibit the toxic action of the infection already present, and to attempt to increase the natural defenses against probable additional infection. We have made use of vaccine therapy in about 940 cases. About 450 of this number received the mixed bacterin, and we believe chronic infections and gleet discharges have been much less frequently encountered than when the usual treatment only was given.

Vaccine therapy seems particularly effective in gonorrhoeal arthritis. It also affords valuable aid in the treatment of

gonorrheoal vaginitis in little girls, though in them the treatment requires great perseverance.

Bacterins if properly used will probably reduce considerably the number of operations for pus tubes in women, for satisfactory results will not infrequently follow, even when the infection has become extensive and deep seated.

THE DOSAGE in the vaccine therapy requires a fineness of judgment sometimes absent. As a rule it is well to begin with somewhat moderate doses, repeated and increased according to the reaction and improvement. Formerly we selected for the injection a more promising period than when the symptoms were acute; at present we think the result is better when the disease is at its worst, especially if it is not a surface-inflammation.

In the mixed vaccine the gonococcus is combined with the bacillus coli, streptococcus, and pseudodiphtheria. Of these 50 million each are added to 100 million each of the staphylococcus aureus, albus, and citreus in 1 c.c. of physiologic salt solution. We use the stock gonococcic bacterin mixed almost exclusively, and administer it in doses of about  $\frac{1}{4}$  to  $1\frac{1}{2}$  c.c. injected into the muscle of the buttock or subcutaneously in the back. Rarely is there a reaction of any importance—a soreness at the site of the injection for a few days, and this is as a rule milder after each injection. There may also be a chill, followed by a rise of temperature and a temporary aggravation of the urethral discharge. This may be considered a good omen because it seems to indicate that the vaccine contains the infecting organisms; if it lasts more than 24 hours it probably means that the dose was too large. It should be remembered that to obtain good results we must produce a reaction. The dose must be sufficient to impress or “jar the immunizing machinery into activity,” yet an overdose should be avoided by gradually

increasing the amount until the immunizing response occurs. A brilliant stroke may sometimes follow a big initial dose, but it is safer to start with 15 to 30 million gonococci, with the proportions of other killed organisms previously given. If all goes well one and one-half or twice the initial dose of the same mixture may be administered from the third to the sixth day. The same dose or a larger one may be repeated at intervals of from 3 to 6 days, or longer, as the reactions and results indicate.

OPSONIC INDEX.—Control by the opsonic index appears unnecessary in gonorrhoea. A negative phase seems unlikely to occur if ordinary care is exercised. Favorable results may as a rule be expected to vary directly with acuteness and activity of the disease, the best being the conditions with the greatest systemic manifestations of the disease. If the process is mild and localized with only a moderate production of pus, the result with bacterins will be less satisfactory, and the course of treatment should be continued with other methods until the cure is effected in spite of its sometimes tedious and discouraging delay. As in the subsiding acute conditions, every care must here be exercised to prevent local injury with its attendant lowered local immunity.

### GONOCOCCIC PHYLACOGEN

Phylacogen is the name given by Schafer to an aqueous solution of metabolic substances or derivatives, generated by bacteria grown in artificial media. A large variety of pathogenic organisms are cultivated at 37 degrees for 72 hours or longer and are then killed; the material is filtered through porcelain to remove all of the bacteria. Cultural tests are made to determine the sterility, and 0.5 per cent. of phenol is added as a preservative.

The different organisms are present in the medium before filtration in about equal proportions. The phylacogen thus made is called basic phylacogen or mixed infection phylacogen. An equal quantity of polyvalent gonococci phylacogen is added to the product marketed under the name, gonococcic phylacogen. While this remedy has been extensively advertised as a cure for rheumatism, we have had little experience in the treatment of this disease. In our use of phylacogen we have not administered the large doses at first recommended—about 5 to 10 c.c. With smaller doses, however, ranging from  $\frac{1}{2}$  to 1 c.c. given intramuscularly every other day, we have seen decided improvement in acute and hyper-acute gonorrhoea when used to supplement the treatment previously described. Practically the same is true of phylacogen that occurs with vaccines, namely, the results at times will be brilliant and at others negative. The phylacogen seems to be more potent than the vaccine. Just how it works we are unable to say, but it seems that it hastens the development of immunity.

There may be a non-sterilizing immunity and although the patient may greatly improve, all of the treatment should be continued until proof is obtained that gonococcic infection no longer exists.

If the large doses are given intramuscularly or subcutaneously or if smaller ones are administered intravenously, the reaction is quite stormy, the patient has a severe chill, a rise of temperature, malaise, aching throughout the body, headache and pain, swelling and redness at the site of the injection (except when given intravenously). In  $\frac{1}{2}$  to 1 c.c. doses intramuscularly or subcutaneously about the same reaction follows that we observe after good size doses of vaccine. Used as an adjunct to our usual treatment we have been convinced that the average time to cure patients with gonococcal infection has been shortened by the use of phylacogen as well as by vaccines,

though at times the results with it have been negative. We have seen no harm follow its administration in these small doses.

SUMMARY.—Vaccine therapy affords valuable supplementary treatment in gonorrhoea, frequently giving satisfactory results, at times brilliant, at others negative, but never, when properly used, harmful.

The deeper infections and more intense inflammations, with decided systemic reactions, respond as a rule more satisfactorily than do mild surface-inflammations.

Gonorrhoea is much easier to cure than is the low-grade inflammation which often follows it, produced by colon bacilli, staphylococci, and other organisms. Since these mild secondary infections are so difficult to cure, no matter what treatment is used, their prevention becomes a matter of great importance; we therefore now always administer in acute gonorrhoea mixed bacterin, hoping not only to raise the resistance against the infection already present, but also to increase the natural resistance to the organisms likely to become implanted during and following this critical period.

This method seems to secure more complete cures, and fewer patients pass through the "gleety" stage which often occurs as an annoying complication or sequel of gonorrhoea. Small or moderate doses of bacterins should be administered at first at intervals of from two to four days. The dose may later be increased and the interval lengthened according to the reaction and result. All measures which promote a healthy local condition should be scrupulously carried out for two or three weeks beyond the time when the urine becomes free from pus.

With  $\frac{1}{2}$  to 1 c. c. of gonococcic phylacogen given every other day we have seen a more rapid cure of gonococcal infections than when this remedy was not employed in connection with the routine treatment.

## CHAPTER V

## EPIDIDYMITIS

CAUSE, DIAGNOSIS, PROGNOSIS, TREATMENT, HAGNER'S EPIDIDY-  
TOMY AND ITS TECHNIC

## GONORRHOEAL RHEUMATISM.

SYMPTOMS, DIAGNOSIS, PROGNOSIS, AND TREATMENT.

## GONORRHOEAL CONJUNCTIVITIS.

SYMPTOMS, DIAGNOSIS, PROGNOSIS, TREATMENT AND SUMMARY.

Epididymitis is an inflammation of the epididymis and is a frequent complication of gonorrhoea. It occurs most frequently between the second and fourth week of the disease, but may be brought on earlier by indiscretions of various kinds, or may come at any time during chronic infection with gonococci or other organisms.

The exciting cause may be any one or more of the following: Strong irritating injections, the passage of urethral instruments, alcoholic or venereal excesses, sexual excitement, physical exertion and traumatism of the epididymis or genital structures. The gonococci are carried back or spread to the deeper parts and pass through the seminal ducts, the ampullations of the vas deferens, and through the cord to the epididymis. Inflammation of the deep urethra and seminal vesicles may or may not cause sufficient trouble to attract attention. It is claimed that a reverse peristalsis may take the germs along rapidly, and without their attacking the seminal duct, vesicle or cord. Judicious treatment with irrigations of the urethra and bladder tend to prevent, rather than to cause, the development of epididymitis.

Premonition of epididymitis is sometimes manifested by pain in the seminal vesicles or in the deep urethra. Occasionally pain or soreness is felt in the lower abdomen just above the groin. This may gradually extend down the vas to the epididymis. More frequently no premonitory symptoms are noticed. The epididymis begins to swell and ache, and gradually becomes very tender; the discharge as a rule ceases, but it returns later; there may be a chill, rise in temperature, malaise, loss of appetite and occasionally severe systemic reaction. The swelling is at first limited to the epididymis, although subsequently, the testicle or the cord between the epididymis and the inguinal ring may become involved. There may be a collection of fluid in the tunica vaginalis. The mass may reach the size of an ordinary fist, the skin of the scrotum may be red and edematous. The pain on movement or pressure gradually subsides, the swelling becomes softer and finally disappears, except a nodule in the epididymis, which may persist for some time. In rare cases a large abscess may form, and, less often still, gangrene of the scrotum may occur. Chronic infection may persist causing recurrent attacks of epididymitis; such infection is, as a rule, non-gonorrhoeal. Neuralgia of the testicle may follow, or there may be a sensitiveness of this organ and the epididymis in neuropathic subjects.

THE DIAGNOSIS rarely involves any uncertainty, if a careful examination is made and the acute course of the disease, together with the above symptoms, is considered. Tuberculosis may originate in the epididymis and cause the production of a chronic epididymitis, less acute and less painful than gonorrhoeal.

THE PROGNOSIS is good, as resolution usually occurs promptly, and more or less completely, in from one to four weeks, under appropriate treatment. Sterility is very likely to follow



double epididymitis. The danger of recurrences depends upon the success in the treatment of the deep seated urethral, prostatic, or vesicular inflammation.

TREATMENT OF EPIDIDYMITIS requires, generally speaking, rest in bed, cold or heat and suspension of the inflamed organ. The swollen part should be kept well up on the symphysis pubis by a suspensory or upon a shelf of adhesive plaster placed across the thighs, the upper border of the plaster reaching to the perineum.

All local urethral treatment should be discontinued until the acute part of the epididymitis has subsided. The application of an ointment, composed of guaiacol 15% and ichthyol 30% in lanoline and vaseline, aids in the reduction of the inflammation and in the relief of the pain. The ice bag also greatly reduces both the swelling and the pain. It should be only partially filled with shaved or finely crushed ice, and the air expelled from it just before the cap is screwed tightly on. The ice bag should be carefully adjusted over the epididymis, which is kept well up on the symphysis pubis and should not be allowed to drag down between the thighs. The guaiacol and ichthyol ointment should be used in conjunction with the ice bag and should be applied twice daily and covered with oil silk to protect the clothing and ice bag from the ointment.

If preferred hot poultices or the hot water bag may be used instead of the ice, but in our experience the cold application is more comfortable and more prompt in the reduction of the swelling. Vaccine therapy may be resorted to and occasionally will be followed by satisfactory results, at other times negative results. The dose need not be less than 50 million gonococci every two or three days. The patient is usually able to get out of the bed in from one to two weeks, occasionally earlier. During the subsiding stage iodide of

potash in doses of  $\frac{1}{2}$  gram ( $7\frac{1}{2}$  grains) to 1 gram (15 grains) three times daily, is administered to hasten the absorption of the infiltration of the epididymis. Snug support in a suspensory or strapping the swollen part with adhesive plaster so as to compress it uniformly will cause a more rapid return to normal and lessen the danger of a relapse.

HAGNER'S EPIDIDYMYOTOMY.—A rational treatment of epididymitis has been suggested by Hagner which consists of incising the swollen epididymis and draining the small abscesses. This operative treatment is not indicated in all cases but only in those where the pain is severe and does not respond promptly to rest and local applications or where there are recurrent attacks. It is further indicated where the patient is particularly anxious to be up and around at the earliest possible time.

TECHNIC.—The scrotum, pubic and perineal regions should be shaved and scrubbed the night before the operation, and a moist 1 to 5,000 bichloride of mercury dressing applied. A cathartic should be given the evening before and an enema a few hours before the operation. The scrotum should again be washed with bichloride and alcohol immediately preceding the operation. If preferred a 2% solution of iodine in alcohol may be applied after shaving and washing with alcohol. A loose, dry sterile dressing should be used after the iodine has thoroughly dried instead of the moist bichloride dressing as the iodine is not effective on the moist skin. Another application should be made just before operating.

As only a few minutes are required for the operation, nitrous oxide gas and oxygen anesthesia is sufficient. The testicle should be turned upward in such a manner that the incision may be made in the lower posterior part, so as to avoid the tunica vaginalis, and while being firmly grasped the scalpel is carried

through the skin and fascias directly into the epididymis. This can be done without changing the hold on the testicle and scrotum. The distinct nodules in the globus major, minor or wherever they can be detected are opened. Only a small amount of pus, as a rule, is found. The skin incision need be only about  $\frac{3}{4}$  of an inch in length and requires no sutures. A cigarette drain is placed in the incision and should be removed in 24 to 36 hours. If hydrocele is present it should be tapped. Sterile gauze and cotton should be applied and held in place by a Peterkin scrotal bandage.

The patient should remain in bed five to seven days. The dressings should be changed every other day. A snug fitting suspensory should be worn when the patient gets up. The incision is allowed to drain without interference until it heals; this will occur in from one to two weeks. The pain is relieved at once by the operation but the swelling and induration require ten days or two weeks in which to undergo resolution.

A saturated solution of nitrate of silver in pure carbolic acid applied just within the incision cauterizes it and prevents its healing too promptly.

Ashcraft has modified the operation of Hagner and makes the incision through the lower anterior portion of the scrotum into the tunica vaginalis and in this manner exposes the epididymis with its many small pockets of pus. These are well opened and the incision in the scrotum is partly closed with cat-gut sutures. Iodoform gauze is placed in the wound for drainage. The after treatment is practically the same for both operations, though Ashcraft recommends that the gauze drainage be replaced several times.

## GONORRHOEAL ARTHRITIS.

This term is applied to the gonorrhoeal inflammation produced in the various synovial membranes of the body. It

may be either a septicemia or a toxemia. At times the gonococci are found in the pus withdrawn from the swollen joints, at others no infection can be demonstrated, and at still others it would seem that the arthritis has been produced by secondary infection with colon bacilli and pyogenic organisms. It is not caused by the inflammation of the external genitals but by involvement of the deep structures, as the prostate, vesicles, etc. The effusion into the joint may be serous, sero-fibrinous or sero-purulent in character, and in many instances the inflammation is limited to the synovial membranes, though it may involve also the adjacent tissues.

**SYMPTOMS.**—The first evidence of the disease is usually pain in one or more of the joints or in the heel, which may be attended with a slight systemic reaction as malaise, fever and chill, all being mild in character except the pain. Gonorrhoeal rheumatism, as a rule, occurs during the latter part of the urethritis rather than early in the disease. The knee, ankle, elbow, shoulder, heel, wrist and hip are the joints most frequently affected, and one or more of these may be inflamed.

Fournier has described three distinct varieties of the disease:

1. Mono-articular inflammation, which most frequently attacks the knee, occasionally the ankle or elbow. This is a sub-acute or chronic variety attended with very little pain, tenderness, redness and few constitutional symptoms, though with a distinct enlargement of the joint characterized by insidious development and slow resolution. Occasionally the constitutional effect may be very pronounced and the joint extremely sensitive.

2. A variety closely resembling articular rheumatism. Several joints are involved and perhaps tendons and other fibrous structures. The local symptoms are much more pronounced than the constitutional. A favorable result, as a rule, occurs,

but there may be a chronic synovitis and partial or complete ankylosis. Suppuration may occur in gonorrhoeal rheumatism, but is not of frequent occurrence.

3. Still another variety is signified by fleeting pains in various joints without any local or general manifestations of the disease. The synovial sheaths of tendons and bursae may become inflamed, especially the bursa in the heel.

Gonorrhoeal inflammation of the knee is sometimes known as gonitis, and when the chief symptom is a serious effusion it is called gonocoele.

THE DIAGNOSIS may be made from the occurrence of the above symptoms during the course of gonorrhoea and in doubtful cases by the complement fixation test. The larger joints are usually affected, and on one side only. The general symptoms are very mild, as a rule the profuse sweating and acid urine which attend rheumatism being absent; nor is the sudden subsidence of the inflammatory symptoms seen as it is in the latter disease.

PROGNOSIS.—Although not dangerous to the patient's life, gonorrhoeal rheumatism is likely to recur or to be very chronic in character, and may terminate in permanent anklosis, hyarthrosis or suppuration, but as a rule resolution will take place—though perhaps slowly. The prognosis depends also upon the curability of the deep focus of infection from which toxemia or metastases occur. Since the advent of the gonococcic vaccine, phylacogen and serum treatment, a much more hopeful prognosis may be given.

THE TREATMENT OF GONORRHOEAL RHEUMATISM is symptomatic and of course varies with the degree and character of the inflammation and the effusion into the joints.

Oil of gaultheria may be given internally, in 15-drop doses, three times daily. Salicylates apparently do little good, but benefit may be derived from aspirin, salol and iodide of potash. Mobilization of the joint or absolute quiet in bed is to be insisted upon in severe cases.

As a local application, equal parts of ichthyol and olive oil may be used on several layers of gauze and over this oil silk and cotton, which are to be held in place with a bandage.

W. J. Robinson recommends the following:

R	Acidi salicylic. -----	4. ʒi
	Mentholi -----	1. gr. xv
	Guaiacoli -- -- --	2. gr. xxx
	Alcoholi -- -- --	30. ʒi

M. Sig.: To be painted on the affected areas with a camel's hair brush and the parts covered with cotton and oil silk.

The urethritis, prostatitis, vesiculitis or any part that is inflamed should always be carefully treated along with the medication for arthritis. Fuller has treated a large number of patients very successfully by opening the seminal vesicles and draining them through a perineal incision. Of course this treatment would be indicated only when there was a severe and chronic rheumatism and a distended and suppurating vesicle.

The skin and bowels should be kept active by the use of pilocarpin and laxatives. If there is doubt as to the diagnosis, salicylate of sodium should be given. Dry heat, the Paquelin cautery, electricity, friction and massage may be tried in obstinate cases. Gonococcic vaccine is particularly indicated in gonorrhoeal rheumatism and in large doses ranging from 50 to 500 million dead gonococci. The dose should be increased from the medium size ones until the immunity balance is impressed. Successful treatment will often come only after the cure or removal of deep seated foci of infection such as in-

inflammation of the prostate and seminal vesicles in men and the uterus and fallopian tubes in women. Gonococcic phylacogen in one c. c. doses intramuscularly every 2 to 3 days or oftener may be of decided value. Larger doses are quite painful and may cause a chill and a rise of temperature.

Good results have been obtained with some patients by the use of Bier's hyperemic treatment.

If the swelling is extensive and there is evidence of pus formation, the joint should be incised, the fluid removed and the cavity drained.

## GONORRHOEAL CONJUNCTIVITIS OR OPHTHALMIA

This is a severe inflammation of the conjunctiva caused by the gonococcus. It usually occurs in individuals having gonorrhoeal urethritis or infected by soiled linen or the fingers of other patients with gonorrhoea. Gonorrhoeal ophthalmia neonatorum is usually acquired from the vagina during birth.

THE SYMPTOMS begin in from twelve to forty-eight hours after inoculation, as a simple conjunctivitis. They rapidly accentuate while a profuse discharge of pus containing gonococci sets in. The lids swell and a ring of infiltration appears near the corneal edge, which impairs its nutrition and may end in extensive ulceration and perforation with prolapse of the iris and its incarceration in the wound. Gonorrhoeal conjunctivitis reaches its height in about ten days, then gradually subsides, occasionally becoming chronic.

THE DIAGNOSIS may be made by demonstrating the gonococcus in the purulent secretion. It must be distinguished from rheumatic gonorrhoeal ophthalmia, which is not due to the introduction of the gonococcus into the eye, but is caused by toxic material absorbed from some focus of infection. The

agnosis may be made by the presence of coincident rheumatism and milder, bilateral symptoms which usually begin in the iris.



Figure 13.—Gonorrhoeal Conjunctivitis. Swelling of the Lids and Free Discharge. (White & Martin.)



Figure 14.—Gonorrhoeal Conjunctivitis. Infiltration of Bulbar and Palpebral Conjunctiva. (White & Martin.)

There is a form of iritis which accompanies gonorrhoea, characterized by a semi-solid exudation from the iris;



but the more common form comes on after at least one attack of inflammation of a joint, most frequently the knee. The origin of the iritis is almost certainly a metastasis. (A. W. Stirling.)

THE PROGNOSIS of gonorrhoeal conjunctivitis is always grave, and unless treated properly from its incipency, serious results will follow.

THE TREATMENT should be begun by protecting the unaffected eye by sealing it with Bullers' Watch-Glass shield. All attendants should be warned of the danger of infection. Prophylactic instillations of a few drops of 1 or 2 per cent solution of nitrate of silver into the eyes of infants immediately after birth will in the majority of cases prevent ophthalmia neonatorum.

Cold is the most useful agent in the early stages and may be applied by placing compresses of wet gauze on a block of ice and then on the eyelids; the dressings should be frequently changed.

The secretion should be washed from the eye with a saturated solution of boric acid or 15 per cent. solution of argyrol. After the discharge has become free and creamy, nitrate of silver in 3% solution should be swabbed upon the everted lids and the excess immediately neutralized with a 3 per cent solution of sodium chloride. (Stirling.) This treatment should be given once daily.

If corneal ulcers form, a 3 per cent solution of atropine should be instilled into the eye every 4 hours to keep the pupil dilated. Hot fomentations should replace the cold applications suggested in the treatment earlier in the disease.

The eyelids should be anointed with vaseline frequently during the entire treatment. Iron, quinine and strychnine should be administered to debilitated patients.

SUMMARY.—Epididymitis is a rather frequent complication of gonorrhoea and is caused by an extension of the infecting organism from the urethra through the seminal vesicles down the vas deferens to the epididymis. The exciting causes may be one or more of the following instrumentation, strong injections or irrigations, physical exercise, sexual or alcoholic excesses, or traumatism. The treatment requires rest in bed, cold or hot applications, guaiacol 15% and ichthyol 30% ointment, vaccines, and perhaps incising and draining the swollen epididymis (epididymotomy).

GONORRHOEAL ARTHRITIS usually attacks the knee, ankle, elbow, shoulder, heel, wrist, and hip. It generally means that there is some deep-seated focus of infection from which the organisms or toxins extend. The cure depends upon locating and eradicating such lesions in addition to treatment of the joint itself. Vaccines and phylacogen afford the most reliable treatment. Rest and local applications will be necessary except in the mild cases.

GONORRHOEAL OPHTHALMIA is a severe inflammation of the conjunctiva caused by the gonococcus. It is due generally to carelessness. The symptoms are a profuse discharge of pus, swelling of the lids, perhaps ulceration and perforation of the cornea. All attendants should be warned of the danger of infection. Cold compresses of gauze wet with ice water should be placed on the eye and frequently changed. The secretion should be washed away with a boric acid solution and 15% argyrol frequently instilled. Later 3% nitrate of silver should be swabbed on the everted lids once daily. If corneal ulcers form, a one per cent. solution of atropine should be instilled into the eye every four hours to keep the pupil dilated.

## CHAPTER VI

WHEN SHALL WE DECLARE PATIENTS CURED OF  
GONORRHOEA?

TESTS: SEARCH FOR GONOCOCCI IN THE PROSTATE GLAND AND SEMINAL VESICLES; COMPLEMENT, FIXATION TEST.

WHEN SHALL WE DECLARE GONORRHOEAL PATIENTS CURED?—This is an exceedingly difficult question to answer, and there is considerable diversity of opinion among the leading authorities upon the subject. Generally speaking, unless there have been reinfections or recrudescences, gonococci are hard to find after two or three years. It is important to remember that there is danger of too much treatment as well as of too little. The patient with a slight watery discharge, only apparent in the mornings, without any gonococci present, may be rendered utterly miserable by persistent, futile treatment. We do not wish to be understood, however, as not advising treatment for uncured, chronic conditions, but wish to warn against overtreatment and the danger of creating sexual neurasthenia by excessively prolonged treatment or harmless conditions. We should of course make a reasonable effort to cure everything abnormal, but at the same time use common sense in determining the extent of such treatment. One of the most important questions to decide is whether or not to give these patients permission to marry.

THE METHOD OF DETERMINING POSITIVELY IF GONOCOCCI ARE PRESENT, especially if the prostate gland and seminal vesicles have been affected, is to create a chemical urethritis and then massage the secretion of these organs into the urethra, after having sealed the meatus with collodion. The

inflamed urethra is undoubtedly the best medium for the cultivation of gonococci, and if any germs be present in the secretions of the deeper structures they will proliferate in this favorable environment and may be demonstrated in the subsequent discharge. This enhances the value of the ordinary methods, and in our work we have found it the most reliable of the various tests. The entire urethra should be irritated by injecting a few drachms of  $\frac{1}{2}$  to 2% solution of nitrate of silver with a blunt pointed urethral syringe. The solution should be squeezed into the deeper parts of the canal or deposited with an instillator, or with a soft catheter having a syringe attached. Two or three hours after the discharge appears the patient should urinate and then have the meatus sealed with collodion. The prostate and vesicles are now massaged and the secretion allowed to remain in the inflamed canal until the patient is compelled to urinate. The first discharge is discarded, the next, however, which forms should be stained and a careful search made for gonococci. If the examination is negative the secretion should be examined about twelve, eighteen and twenty-four hours later. If the patient cannot present himself at suitable times for the collection of the smears, he should be shown how to make them, and be provided with slides.

The required strength of the nitrate of silver to be used should be determined by the previous treatment and by the tolerance of the urethra. Little pain is caused by the collodion. The lips of the meatus are pressed together so as to be slightly invaginated before sealing. Of course the simple methods of searching for gonococci should be exhausted before carrying out the above procedure. A few bottles of beer, taken the night before producing the discharge, increases the possibility of arousing the germs, as does overdoses of gonococcic vaccine. Gonococci always produces pus; therefore, if it is not present after dissipation, it is a strong point in favor of the cure being complete.

In women much care is required in examining smears of the discharge taken from the cervix uteri, or any suspected point, before declaring the patient free from infection. Generally no positive statement should be made immediately unless the germs are found; and if one has failed to find them, then the possibility of their lurking in some protected recess should be considered.

The complement fixation test seems quite reliable and should be employed in all instances where doubt exists.

COMPLEMENT FIXATION REACTION IN GONORRHOEA.—This test was first applied by Mueller and Oppenheim, and later confirmed by a large number of observers. Schwartz and McNeil used with more uniform results a polyvalent antigen prepared from twelve different strains of gonococci. Gardner and Clowes carried out a series of tests to determine wherein the results accord with the clinical condition, and to find if the reaction was truly specific. Their conclusions were as follows:

“The complement deviation reaction for gonorrhea, when carried out with a polyvalent gonorrheal antigen by the method recommended by Schwartz and McNeil, gives remarkably reliable results and permits of a specific differentiation, even in the presence of syphilis and other diseases exhibiting complement deviation phenomena.

“The cases giving a triple or double plus gonorrhoeal reaction were all undoubted cases of gonorrhea; although it appears probable, as heretofore stated, that in certain severe chronic cases the reaction may persist for some time after a cure has been effected.

“The cases giving a negative gonorrheal reaction (with one exception, previously referred to, and acute cases within twenty-one days of infection), failed on examination to show diplococci, and may be considered probably free from the disease.

"The cases exhibiting a triple plus Wassermann reaction for syphilis gave for the most part a negative reaction in the gonorrheal series, and when a strong positive gonorrheal reaction was obtained there is little doubt that gonorrhea was, or had been present.

"It is remarkable that in this series of 185 cases, seventy of which exhibited a strong reaction in the gonorrheal or syphilitic series, only seven cases, or 10 per cent., gave a strong reaction in both. A slight reaction is of unquestionable value in diagnosis, but, as in the case of a slight Wassermann reaction for syphilis, should never be considered final.

"We have up to the present failed to find a single normal individual exhibiting a definite reaction when tested with the gonorrheal antigen."

Gardner and Clowes employed the polyvalent antigen prepared by the Schwartz and McNeil method which the former writers describe as follows:

"Ten strains of micrococcus gonorrhoea are grown on ascites agar for twenty hours, removed to an equal number of bottles for each culture and grown for a further twenty-four hours at 37°C., and tested as regards their purity. The growth from each bottle is then removed with sterile salt solution, shaken, and extracted for eighteen hours; two per cent. cresol is added, and the mixture, after standing for a further twelve hours, is filtered through sterile asbestos and subsequently through a Berkefeld filter, tested for sterility, and suitably diluted for employment as antigen. We have used the acetone precipitated fraction of an alcohol ether extract of sheep's kidney as antigen for the comparative Wassermann syphilitic series. A rabbit anti-goat hemolytic system was employed in both cases, the concentration of the individual constituents being varied to suit working conditions. The sera tested in the experiments reported in this paper were invariably inactivated in advance by

heating for thirty minutes at 57 or 58 degrees C. After numerous experiments, in which the gonorrhoeal antigen was used at concentrations ranging from 0.1 to 0.01, we finally decided to use a system consisting of 0.05 of the antigen, 0.15 c.c. of the serum to be tested with from 0.1 to 0.09 c.c. of a 20 per cent. guinea pig serum as complement, and 0.5 c.c. normal salt solution. After a preliminary incubation of thirty to thirty-five minutes, the activity of the residual complement was tested by the addition of a hemolytic system consisting of 0.1 c.c. of a five per cent. suspension of goat's corpuscles and from 0.25 to 0.3 of a one per cent. rabbit anti-goat serum.

"The effect of variation in the amount of antigen employed is well illustrated by the following preliminary experiment, in which we compared the action of the sera of three cases: 1, Chronic gonorrhoea of long standing showing Neisser; 2, a suspected case of gonorrhoea, Neisser demonstrated later; and, 3, a normal; from which it will be seen that No. 2 gives an uncertain reaction with concentrations of antigen under 0.05 c.c.

Antigen concentration	1.	2.	3.
0.1	+++	+++	—
0.05	+++	+++	—
0.025	+++	++<	—
0.01	++	—<	—

"In recording our results we have indicated roughly by means of the signs: + (greater than), and — (less than), the extent of the reaction obtained. Among the 185 cases were included 106 of gonorrhoea or with a history of gonorrhoea, forty of syphilis, eleven of cancer, three of tuberculosis, and twenty-five normals."

Schwartz and McNeil summarize a later report on the complement fixation in gonorrhoea as follows:

"A positive reaction denotes the presence of recent activity in the body of a focus of living gonococci. A negative reaction does not exclude gonococcus infection, but, for the reasons

stated, should be accorded considerable importance. A strong positive reaction is not to be expected earlier than about the fourth week, and then only in very acute cases with some complication. A positive reaction is not obtained if the disease is limited to the anterior urethra. A positive reaction does not entirely disappear until seven or eight weeks after cure. In other words, if a strong positive reaction is obtained seven or eight weeks after apparent clinical cure, the patient should be looked on as still harboring gonococci. In chronic cases, isolation of the gonococcus in culture is the only absolute, bacteriologic proof of gonococcal infection. The technic of a complement fixation test is simpler than that of isolation of the gonococcus in culture and the possibilities of error are less. In cases regarded clinically as post-gonorrheal, a positive reaction is obtained in 31.4 per cent. In sixty-two cases of chronic prostatitis giving a history of gonococcal infection within three years a positive reaction was obtained in 54.8 per cent. In 165 patients looked on as clinically cured for at least three months, a positive reaction was obtained in 13.2 per cent. In women, a positive reaction is probably not obtained unless there is at least some involvement of the cervix. On account of the unreliability of the bacteriologic diagnosis of gonococcal infection in women, the complement fixation test should prove of special usefulness in gynecologic conditions."

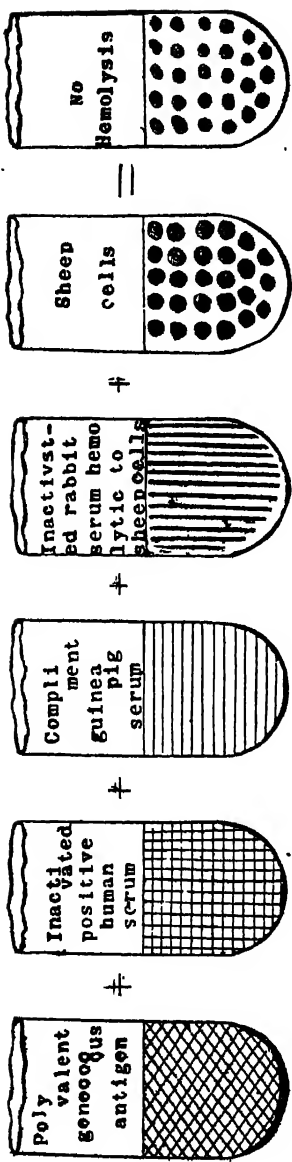
SUMMARY.—Tests to determine if gonococci are still present need not be made, as a rule, as long as evidence of inflammation still exists, for no matter what organism is present the patient should continue treatment. The prostate gland, seminal vesicles, Cowper's glands and crypts and follicles of the urethra are usually the foci in which we find latent or chronic gonococcic infection. If dissipation tests are negative and the patient remains well for several months, we may tentatively assume that he is free from infection unless he wishes to marry.



In such cases more detailed tests should be made, searching for gonococci and with the complement fixation tests.

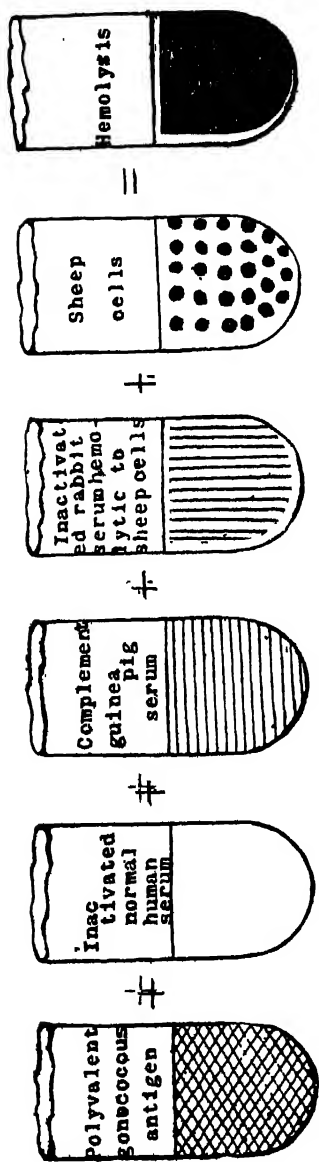
The urethra should be irritated by injecting 1-2 to 2 per cent. of solution of nitrate of silver; two or three hours after the discharge appears, the patient should urinate and then have the meatus sealed with collodion. The prostate and vesicles are now massaged and the secretion allowed to remain in the inflamed urethra until the patient is compelled to urinate. The urethral discharge is examined once or twice daily for two or three days. If unable to present himself the patient may collect the smears for subsequent examination. Gonococci may thus be demonstrated when the usual tests are negative. Negative cultures are of little value, as the gonococcus is not easily grown and experienced bacteriologists may fail to secure a growth when gonococci are known to be present.

The complement deviation test, when carried out by expert serologists, with polyvalent gonorrhoeal antigen, affords the most accurate method of detecting latent gonorrhoea, especially in gonorrhoeal rheumatism and tubal infection. A positive reaction denotes the presence of recent activity of living gonococci but does not necessarily exclude the presence of gonococci. A positive reaction is not obtained if the infection is limited to the anterior urethra. The reaction may not become negative until seven or eight weeks after the gonococcic infection has been cured.



### POSITIVE GONORRHOEAL COMPLEMENT FIXATION TEST.

There is no hemolysis because all the complement is consumed in binding the gonorrhoeal antibodies and antigen, leaving none to complete the combination for destruction of the sheep cells. (Owen & Snure.)



### NEGATIVE GONORRHOEAL COMPLEMENT FIXATION TEST.

In normal serum there are no gonorrhoeal antibodies to bind the guinea pig complement to the antigen, so the complement is free to complete the second combination, that of the sheep cells and hemolytic serum, with a resulting hemolysis of the cells. (Owen & Snure.)

## CHAPTER VII

## GONORRHOEA IN WOMEN AND LITTLE GIRLS

ORGANS AFFECTED IN WOMEN, SYMPTOMS AND COURSE, DIAGNOSIS,  
PROGNOSIS, GONORRHOEA AND MARRIAGE, GONORRHOEAL  
CERVICITIS AND ENDOCERVICITIS, GONORRHOEAL, ENDO-  
METRITIS, SALPINGITIS, TREATMENT OF URETHRITIS  
IN WOMEN, TREATMENT OF SALPINGITIS,  
CERVICITIS AND ENDOMETRITIS, THE  
TREATMENT OF VULVO-VAGINITIS  
IN LITTLE GIRLS, SUMMARY.

Unfortunately gonorrhoea is very frequently present in women and is a primary cause of many serious gynecological affections. It is variously estimated that from 50 to 75 per cent. of all abdominal operations on women are for conditions caused by gonococci. Therefore the utmost care should be exercised in curing male patients who have gonorrhoea and equal care taken in applying tests to determine the completeness of the cure before declaring such individuals fit for marriage.

ORGANS AFFECTED IN WOMEN.—The organs usually affected in women are the vulva, vagina, urethra, uterus, tubes, rectum, Bartholin's glands, Skene's glands and the bladder. The inflammation not infrequently spreads to the ovaries and pelvic peritoneum. On rare occasions it may ascend from the bladder to the ureters and kidneys. Gonococcal arthritis may also develop from the extension of the organisms or toxins to the synovial membranes. Gonococci may invade the blood stream and produce endocarditis. Secondary infection with

colon bacilli, staphylococci, streptococci, and other organisms is made possible by the invasion with gonococci. These organisms, otherwise more or less harmless in the vagina, urethra, uterus, and tubes, may then become dangerous. Not infrequently gonococci may remain dormant until childbirth; and then active inflammation is set up; after this the woman may remain sterile. This is known as one child sterility.

**SYMPTOMS AND COURSE.**—Gonorrhoea in women begins with a slight burning and smarting on urination. This gradually grows worse and the urethra and vulva become hyperemic and sensitive. A purulent leucorrhoea is soon established, later this may become greenish in color or mixed with blood. As the inflammation becomes well developed there may be a chill, fever, rapid pulse, malaise and pain in the pelvis and neck of the bladder with frequent and painful urination. The incubation period in women is about the same as in men, varying from three to eight days. The early symptoms may be so mild at times that they are entirely overlooked. The inflammation does not necessarily run such a severe course as that just described but may be subacute from the start. As women are accustomed to a certain amount of leucorrhoea, this secretion disturbs them less than it does men, who have urethral discharges, and so they may remain ignorant of the character of the disease until a pus tube, vulvo-vaginal abscess, or pelvic inflammation requires the attention of a surgeon or gynecologist.

**DIAGNOSIS.**—The diagnosis of acute gonorrhoea is easily made by the examination of smears taken from the urethra and later from the cervix uteri. Secretion from the vagina may contain so many other organisms that it is impossible to state positively that gonococci are present. Purulent urethritis, vulvitis, vaginitis, etc., following intercourse with a man not known to

be free from gonorrhoea will nearly always prove to be due to the gonococcus. Chronic gonorrhoea in women may be much more difficult to diagnose with certainty. When the history is not clear and when gonococci cannot be detected a positive statement should not be ventured until many examinations have been made and until a complement fixation test has been done.

**PROGNOSIS.**—From the foregoing remarks it is clearly shown that gonorrhoea is a serious disease in women and may be very difficult to cure. Vaccine therapy aids materially in its cure, but in spite of the most careful treatment pus tubes and serious complications may arise that require major operations in addition to medical remedies. The disease may remain more or less quiescent for years and the woman continue to infect those who have sexual intercourse with her and yet the symptoms remain so obscure that she is unaware of her infection. Sterility or one child sterility is quite likely to follow gonorrhoea. Much of the sterility of prostitutes is thus caused.

**GONORRHOEA AND MARRIAGE.**—We must not forget that reinfection of the male accounts for much of the marital infection with gonorrhoea, though much also results from latent infection in the male. For detection of such infection see section devoted to this subject. In making examinations to determine the presence of gonococci we should remember the responsibility placed upon us. The health and happiness of a man and his wife and the eyesight of his offspring is at stake; therefore, the utmost care should be exercised. Ministers should demand a premarital certificate of health before performing the marriage ceremony, until legal measures are enacted to protect innocent women and babies.

**GONORRHOEAL CERVICITIS AND ENDOCERVICITIS.**—The cervix uteri is a favorite site for gonococci to produce.

inflammation and to lie dormant. In acute conditions the mucosa is swollen, reddened and everted, emitting a purulent discharge. The glands gradually become hypertrophied and pour out an abundant tenacious "white-of-egg-like" secretion. The discharge differs decidedly from the vaginal secretion, which is milky or curdy in appearance. Of course when the conditions are acute these differences are not apparent. Cysts not infrequently form in the cervical glands. These are known as Nabothian follicles. The diagnosis should include a stained smear from the cervix. This, as a rule, is the easiest place in which to demonstrate gonococci in chronic gonorrhoea in women. Intracellular Gram negative diplococci taken from the cervix nearly always mean that the inflammation is gonococcal. If in doubt cultures should be made and the complement fixation test done.

**GONORRHOEAL ENDOMETRITIS.**—Inflammation of the lining of the uterus always begins in the cervix and may be acute or chronic in character.

The symptoms of the acute form with coexisting inflammation of other parts of the genito-urinary tract after suspicious intercourse, especially with an urethritis, affords strong presumptive evidence that the inflammation is due to gonococci. A smear taken from the cervix will be necessary before making a positive statement. The history is often not at all clear, the onset being insidious and little thought is given to the leucorrhoea. By manual examination the womb is found to be enlarged, softened and tender; the cervix is swollen and the canal is patulous. If the infection has extended to the Fallopian tubes, they, too, are enlarged.

**SALPINGITIS** is an inflammation of the Fallopian tubes and is usually an extension of the infection from the endometrium. Gonorrhoea and sepsis are the most frequent causes and the

former is far more common than the latter. The disease may be either acute or chronic and is usually bilateral. When the abdominal and the uterine openings of the tubes become closed a collection of pus forms which is called pyosalpinx or pus tube. At first the pus is always septic, but in old cases the pus is found to be sterile in about 50 per cent.

The infection may extend through the abdominal end of the tubes to the peritoneum, or to the cellular tissue of the broad ligament, or the pus may escape into the pelvic cavity. Adhesions may form between the tube and surrounding organs.

Local peritonitis is of more frequent occurrence than general peritonitis.

The symptoms of acute salpingitis are closely associated with those of endometritis and localized peritonitis which usually coexist. The extension of gonococci to the tubes and peritoneum is a comparatively slow process and may remain subacute or chronic with ill-defined symptoms. Pain is a constant symptom; dysmenorrhoea, and an excessive flow are usually present. The patient's health is below normal, she is generally sterile and has recurrent acute attacks.

The diagnosis requires a painstaking history and careful physical and bacteriological examinations—perhaps also a complement fixation test.

The prognosis of gonococcal infections of the Fallopian tubes usually is good as regards any immediate danger to life but permanent damage may be done to the tubes and a major operation may be required.

**TREATMENT.**—The patient should be scrupulously clean. In acute conditions rest in bed should be recommended. Probably one reason for so many pus tubes is that the physician frequently must remain ignorant of the real character of the disease and consequently does not exercise the care



to prevent spreading of the infection nor does she take sufficient treatment.

Vulvar pads of sterile gauze or cotton should be worn constantly and burned promptly after being soiled. The external genitals should be bathed several times daily, hoping thus to prevent ophthalmia, proctitis, and spreading of the disease to others. All soiled linen should be thoroughly sterilized by chemical agents or heat. Coitus should be forbidden. A very large quantity of water should be consumed to dilute the urine and wash out the urethral discharge. During the acute stage the patient should take copious vaginal douches of potassium permanganate 1 to 5,000 in physiologic salt solution once or twice daily. About 4 liters (1 gallon) of water as hot as can be borne comfortably should be used at each treatment. The solution should be placed in an irrigating douche can about 1 meter (3 feet) above her bed. She should lie upon her back with a douche pan under her hips. In addition to the douches, vaginal injections of argyrol 3% or protargol 1% should be taken once or twice daily, alternating with the douches, but they should not be given immediately before or after them. In giving these injections it is of importance that the medicine be held in the vagina for at least a half hour. In order to attain this a syringe should be used that has a conical end so that when pressed against the vulvo-vaginal outlet it will prevent the escape of the solution. About 30 c.c. (1 oz.) of the solution should be used at each injection. A two-ounce, hard-rubber, blunt-pointed ear syringe may be used satisfactorily for this purpose. While taking the injections the patient should be reclining on a bed with towels, cloths, or newspapers placed under the hips to catch the solution that escapes. While this plan of treatment is tedious it is more effective than any other we have tried, provided the patient is faithful in following

the details. Internal measures should be prescribed in addition to the douches and injections.

As the inflammation subsides or becomes chronic it may be substituted by local applications, having the patient in a knee

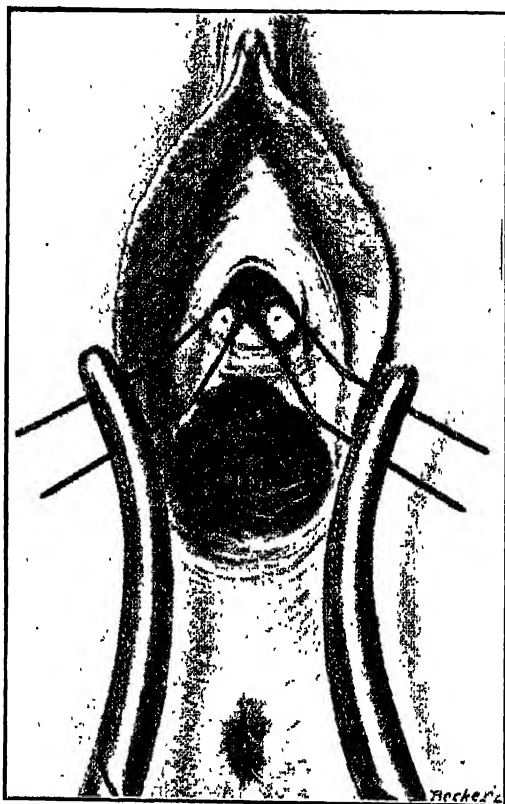


Figure 15.—Bent Hairpins Grasped in Artery Forceps and Used as a Speculum to Expose the Anterior Portion of the Urethra, More Particularly the Orifices of Skene's Glands. (Kelly.)

chest position. With the aid of a Sims speculum the vagina is wiped clean with pledgets of absorbent cotton wet with warm sterile water held in dressing forceps. It is then dried with cotton or gauze. The cervix and entire vagina should then be wiped with a 10% solution of protargol or a 5% solution of

silver nitrate. The tip of the applicators should not be pressed through the cervix until there is positive proof that the endometrium is infected. This treatment may be repeated once or twice weekly, douches and injections being taken about once daily in the meantime.

TREATMENT OF THE URETHRITIS.—If the first portion of the urine contains pus, when the vulva has been washed previously to exclude contamination, and the latter portion of the urine is clear, it shows that there is an urethritis. This is nearly always present in gonorrhoeal infection as the organisms seem to flourish on the columnar epithelium of the urethra. About 30 c.c. (1 oz.) of a 4% argyrol solution injected into the urethra and forced (gently) on into the bladder once daily by the physician affords about the best local measure that we can recommend. The bladder should be emptied just before the treatment is given. The blunt point of the syringe is engaged in the meatus urinarius and after the injection has been made should be held in place for five or ten minutes so as to procure a thorough application to the urethra. The passage of the solution through the inflamed urethra into the bladder does not produce inflammation of the bladder. As the condition becomes chronic a  $\frac{1}{4}$ % solution of silver nitrate may be injected in the same manner except that the bladder should not be emptied and the solution should not be retained in the urethra. One-half or a one per cent. solution of protargol may be used instead of argyrol.

The opening of Bartholin's and Skene's glands should be examined, and if inflamed, a 10% solution of silver nitrate should be injected with a hypodermic syringe connected to a blunt pointed hypodermic needle of 20 gauge. If pus collects and forms an abscess, it should be opened, under cocaine anesthesia, and drained.

TREATMENT OF SALPINGITIS AND PYOSALPINX.—In recent years a much more conservative plan of treatment has been evolved for inflammatory conditions of the uterine appendages, and operative interference is less frequently resorted to, as it was attended with an unnecessarily high mortality. Many women regain their health with less radical measures. Hot sitz baths, hot fomentations over the lower abdomen and rest in bed in addition to the local treatment previously recommended for endometritis and vaginitis comprise the main remedies. Vaccine therapy affords one of our most valuable means of combating such infections. The dose should be small at the start and gradually increased. (See chapter devoted to this subject.)

TREATMENT OF CERVICITIS.—This obstinate gonorrhoeal infection requires persistence in the general measures previously mentioned, including vaccine therapy, and local application of 5% to 10% solutions of nitrate of silver about once weekly. Curettement of the endocervical membrane serves to break down and lay open the diseased glands and thus provides free drainage. This treatment may have to be repeated every two weeks until several curettements have been given. A boro-glycerine tampon should be applied to the cervix after each treatment.

TREATMENT OF ENDOMETRITIS.—If acute the treatment should always be palliative; rest in bed, hot vaginal douches, hot fomentations, and mixed gonococcic vaccine. Later may be added tampons and 10% solution of nitrate of silver applied locally, and finally a curettement followed by boro-glyceride tampons and douches.

THE TREATMENT OF VULVO-VAGINITIS IN LITTLE GIRLS.—Cleanliness and care to protect other members of the family

become particularly necessary in the treatment of little girls in whom gonorrhoea generally runs a stubborn course. The local treatment should consist of douches of 1 to 6,000 permanganate of potash once or twice daily; injection of 5% argyrol or 1% protargol and held in the vagina one-half hour daily, as described in the treatment of women. Mixed gonococcic vaccine, in doses ranging from 2 to 30 million, gonococci, every four to eight days shortens the course of the infection. As the discharge diminishes, the interval between the douches and vaginal injections may be lengthened. In the chronic stage of the disease a 1-4000 nitrate of silver may be substituted for the permanganate in the douche.

The treatment should be persisted in until all discharge ceases and until gonococci remain permanently absent. Unfortunately this often requires prolonged attention.

**SUMMARY.**—Gonorrhoea in women is a serious and common affection, and causes from 50 to 75 per cent. of abdominal operations in women. The organs usually affected are the vulva, urethra, vagina, uterus, tubes, ovaries, Bartholin's glands, Skene's glands, rectum, bladder, ureters, kidneys, synovial membranes and endocardium. It begins in women as a smarting on urination and a soreness around the vulva. Purulent leucorrhoea develops and gradually grows worse, becoming profuse. Many times the disease may start insidiously and may not be recognized by the patient as gonorrhoea. The diagnosis is established by the history, the examination of smears taken from the urethra or cervix, and by the complement fixation test, in long standing obscure conditions. Scrupulous cleanliness is most important. In acute gonorrhoea the chief measures are: rest in bed, vulvar pads, copious hot vaginal douches of 1 to 5,000 permanganate of potash, vaginal injections of 3% argyrol or 1% protargol held in the vagina for a half hour, drinking of large quantities of water and vaccine therapy. In

chronic conditions local applications are made with 5% solution of nitrate of silver to the vagina and cervix—the patient being in the knee chest position. The urethra should be injected (by the physician) with 5% argyrol or  $\frac{1}{4}$ % protargol once daily. Salpingitis and pyosalpynx may respond to rest, hot sitz baths, hot fomentations, and gonococcic vaccine, and thus obviate a major operation. Chronic endocervicitis requires local applications and curettement to lay open the diseased glands.

Gonorrhoea in little girls requires persistent douches of 1 to 6,000 permanganate, argyrol 5% or protargol  $\frac{1}{2}$ % held in the vagina one-half hour once daily, and gonococcic vaccine in doses ranging from 2 to 30 million once or twice a week.

## CHAPTER VIII

## STRICTURE OF THE URETHRA

CLASSIFICATION, LOCATION, PATHOLOGY, SYMPTOMS, DIAGNOSIS, MEATOTOMY, EXPLORATION OF THE URETHRA, PROGNOSIS AND SUMMARY.

STRICTURE OF THE URETHRA.—The term stricture is derived from the Latin, *stringere*—to bind, and may be defined broadly as a diminution in the caliber of the urethra by a deposit of fibrous tissue produced by inflammation or injury of the wall of the urethra. There may be sufficient encroachment on the canal by urethral, peri-urethral, or prostatic inflammation or by an abscess to cause retention of the urine or to prevent the introduction of an instrument; but this is not properly classed as an urethral stricture. There may be also a spasmodic condition of the urethral muscles which acts temporarily as a stricture, but differs greatly from the narrowing due to the organized infiltrate or cicatricial tissue left by urethritis or traumatism of the urethra. There is a congenital stricture not included in the above definition. This, however, is not of frequent occurrence.

Sir Henry Thompson says there are no diseases so successfully managed, if one understands what he is about, nor any in which he may make such dangerous mistakes, if not thoroughly familiar with the subject. The urethra is a delicate and elaborate structure, and possesses a sensitiveness to pain which is not surpassed by any part of the body. Consequently great care should be taken to avoid injury or infection, no matter what form of treatment is being applied.

CLASSIFICATION.—Organic strictures are variously subdivided according to their size, characteristic, degree of organization, caliber and mode of origin.

The classification based upon the size is: (1) Linear Strictures—like a cord tied around the penis. (2) Annular Strictures—like a band around urethra. (3) Tortuous Strictures—which involve 5 cm. to 7 cm. (2 to 3 inches) of the urethra, and change it into a devious, irregular canal.

Their characteristics when treated furnish another classification: (1) Simple Strictures—readily dilatable. (2) Irritable Strictures—hyperesthetic and bleed easily; probably a better name for these would be inflamed strictures, as it suggests appropriate treatment. (3) Resilient or Elastic Strictures—easily dilated but recontracting almost immediately.

According to the stage of organization we have Soft or Recent Strictures—before the inflammatory exudate has undergone organization. (2) Cicatricial or Inodular Strictures—after complete organization.

There is another arbitrary division into stricture of large caliber, comprising those above 15 F., and strictures of small caliber which are 15 F., and below. Strictures are also called permeable or impermeable, depending upon whether or not an instrument can be passed; this, however, has to do with skill of the surgeon as well as the conformation of the constriction. Urine can nearly always pass, even in tight strictures, therefore it is not logical to call them impermeable. (Von Bergmann).

LOCATION.—The consensus of opinion is that the majority of strictures are found in the bulbo-membranous region; next comes the first 6 cm. (2 1-2 in.) of urethra. In years gone by a lively controversy raged about the point. Thompson and his followers claiming the former view was correct, while Otis and his school believed the anterior portion of the urethra was the



most frequent seat. Otis claimed a stricture is most likely to form where the inflammation begins the earliest and rages the hottest, but many surgeons believe it occurs most frequently where the inflammatory process persists the longest, and this is in the bulbo-membranous region.

As to the number, there is also diversity of opinion, although the majority believe they are usually multiple. The possibility, however, of a stricture or a point of irritation in the anterior urethra causing a muscular spasm in the deeper urethra, which simulates a stricture, must always be remembered. This idea was advanced by Follet in 1859, and has been verified by many subsequent observations. Lydston thinks points of normal narrowing or inelasticity act as predisposing factors in determining the site of a stricture.

**PATHOLOGY.**—The pathology seems to have been unknown to the ancients, who believed that retention of urine was caused by “caruncles,” “excrescences,” etc., and it was not until 1765 that Dionis first showed, by the post-mortem examination of those who were supposed to have suffered from these “carnosities,” the real nature of the stricture. These views were not generally accepted for many years. In 1793 Benjamin Bell championed the cause of those combating the theory of “excrescences,” and advanced ideas very similar to those prevailing to-day. Desormeaux in 1865 discovered patches of localized inflammation with granulations, and called the condition granular urethritis. Gouley agreed with him that this was the formative stage of a stricture.

These granular patches or inflamed glands may produce a deposit of round-cell infiltration, which is in reality a barrier thrown up by nature to limit the inflammation, but which gradually becomes organized and forms a stricture. There are, however, cases occasionally encountered where the obstruction

is a "membranous septum" partially occluding the canal. The method of its formation is not understood.

Rupture of the urethra in severe chordee or by traumatism is repaired by round cells which later form fibrous tissue and cause the worst form of gonorrhoeal strictures. The inflammatory exudate may be limited to the submucous and perifollicular tissue, but later may involve the corpus spongiosum, and has mixed with it the normal tissues of the urethral walls. As the infiltrate gradually changes to fibrous tissue, the normal parts are absorbed, until finally, in long-standing cases, it is changed completely into dense, firm, fibrous tissue and is then an inodular stricture.

The canal in front of the constriction is usually more or less inflamed. The urethra may become smaller on account of its not being dilated by a full-size stream of urine, and also because of the inflammatory process.

Posterior to the stricture an inflammation is constantly seen, and is due to the presence of a small amount of urine which is not expelled on account of the constriction and the irregular muscular action of the urethral walls. This retained urine acts as a foreign body and irritates the mucous membrane and increases the inflammation. Most of the discharge and shreds come from this point, and if the inflammation progresses, superficial or deep ulceration may take place, an abscess may form and rupture and fistulae result. Urine may be forced into the tissues through this rent, and if it is extensive, dangerous extravasation follows. Its usual course is down into the scrotum and up on the abdominal wall, but it depends upon the location of the rupture.

Just as in all chronic urethral inflammations, the epithelial lining is thickened and there is a partial desquamation with a tendency toward the transformation of cylindrical epithelium into the stratified pavement variety. (White & Martin). The

openings of the glands and follicles become dilated, and there may be reticulated condition behind the stricture. The mucous membrane may be dilated into pouches at the weak points in the surrounding tissues, and here, where the urine is not swept out at each act of urination, it may undergo decomposition and form calculi. The inflammation extends back toward the bladder, involving the glands of Cowper with their ducts, the prostate gland, the ejaculatory ducts and the seminal vesicles. There may be urethrocystitis with frequent urination, tenesmus and an urgent desire to urinate. The mucous membrane of the bladder may become inflamed and result in some of the various changes which occur in cystitis. If unrelieved the bladder wall hypertrophies to overcome the retardation of the flow of urine. This may progress to concentric hypertrophy, where the wall becomes 1 to 2 c.m. ( $\frac{1}{2}$  to  $\frac{3}{4}$  inch) thick, and the capacity of the bladder is greatly diminished. A more likely change, however, is gradual dilatation and thinning of the wall, eccentric hypertrophy, the mucous membrane being forced out into sacculi at the points of least resistance. Here retained urine may decompose and form encysted calculi. The weakening, thinning, and distention may cause the bladder to rupture with extravasation of urine. This occurs less frequently than rupture of the urethra.

The inflammation and dilation finally involve the ureters, with a thinning of their walls and an extension of the process to the kidneys. The urine now contains considerable albumin, and there is a deposit of round cells throughout the kidney substance. Infection may reach it and abscesses form, resulting in the condition known as surgical kidney. Of course it is only in the severe cases that these serious pathological conditions arise.

**SYMPTOMS OF STRICTURE.**—There is generally a history of a severe attack of urethritis with painful erections and per-

haps a broken "cord" or a very prolonged chronic discharge, or repeated attacks of gonorrhoea or of injury. A gleet discharge with threads and pus in the urine is nearly always found, and is usually caused by the inflammation at the constriction or just behind it.

Frequency of micturition is nearly always encountered and is due to the deep urethritis, cystitis, retention of urine or reflex irritation. Dribbling of urine after micturition is another common symptom and results from the imperfect action of the urethral walls in forcing out the final drops of urine. This should not be confused with the more serious condition, the overflow of retention. The urinary stream is smaller and its shape may be distorted if the stricture is at or near the meatus. There is difficulty in starting the stream and it is expelled with less than normal force. In advanced cases it may come only in drops and after much straining, which may cause hemorrhoids, hernia, etc. Pain is not usually severe and is dependent upon and proportionate to the inflammation. It varies from a slight burning at the meatus, stricture or in the deep urethra, to severe pain and tenesmus at the neck of the bladder. There may be reflex pains in the testicles, along the vas deferens, deep in the pelvis, in the lower abdominal wall, in the loins, or in the lumbar or sacral region. The pains may be short, shooting or of a dull, aching, neuralgic character. Prostatitis is likely to occur, with all its symptoms. Complete retention may be caused by exposure to cold, by fatigue, by excesses eating, drinking and sexual intercourse, or by prolonged ungratified sexual desire. Hugh Cabot has called attention to the infrequency of prostatic hypertrophy in strictured patients. According to our theory of such enlargements of the prostate its failure to do so in stricture may be due to the constant inflammation back of it which prevents the growth of attenuated organisms to which we refer later.

Sexual intercourse may be interfered with in many ways. The inflammation of the prostatic urethra may cause premature ejaculation, or it may be long delayed, the normal pleasurable sensation being entirely lacking, or the erection may subside before the completion of the act. Extensive infiltration of the corpus spongiosum may prevent a full erection. The congestion incident to the erection may increase the tightness of the stricture so that the semen is prevented from passing out; this may cause pain by distention of the inflamed urethra, and the semen may dribble out after the penis has become flaccid. In other cases it may pass back into the bladder.

Neurasthenia, melancholia with suicidal tendency, malaise, headache, sleeplessness, and despondency may be caused by stricture.

**DIAGNOSIS OF STRICTURE.**—The history and symptoms usually point toward a stricture but cannot be depended upon in making the diagnosis—an exploration of the urethra being necessary. The patient should urinate in the presence of the surgeon, who may estimate the caliber of the stricture from the size and force of the stream. The urine should be collected in two or three glasses to determine if the deep urethra and bladder are inflamed. If the urine contains much albumin and bacteria in addition to pus, epithelial cells and mucus, preliminary treatment with urinary antiseptics and diluent drinks, a few days, is advisable to lessen the danger that might arise at the instrumentation.

The urethra should be explored with gum or metallic bulbous bougies or an Otis urethrometer. Among the many advantages claimed for this latter instrument is its capacity to ascertain the locality and caliber of any stricture present, without reference to the size of the meatus. It enables the surgeon to make the examination of several strictures by a single introduction of the instrument. The exactness ob-

tained by this method, however, is likely to make the surgeon mistake normal narrowings for strictures, therefore, the symptoms and history must always be considered in reaching a diagnosis.

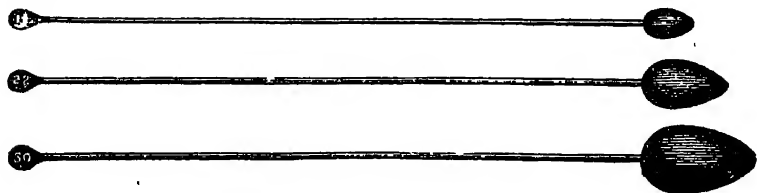


Figure 16.—Bulbous Bougies.

Very satisfactory diagnoses may be obtained with bulbous bougies. Those made of gum are safer, but they have the disadvantage of easily deteriorating.

A meatus narrower than 24 to 26 F. should be enlarged to 29 to 32 F., care being taken not to have it larger than this after the contraction incident to healing, which is 1 or 2 sizes F.

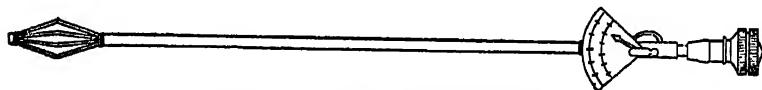


Figure 17.—Otis' Urethrometer.

**MEATOTOMY.**—Painful urination after meatotomy and the necessity for subsequent instrumentation to prevent the surfaces from growing together may be prevented by cauterizing the incised area with a saturated solution of nitrate of silver in concentrated carbolic acid.

For some time we have utilized this method when meatotomy was done and have found it a distinct improvement in the technic. The penis should be thoroughly cleansed. A few crystals or a tablet of cocaine should be deposited within the meatus and allowed to remain there five minutes. A rubber band is then wrapped around the penis so as to prevent hemorrhage. A straight blunt pointed bistoury is used to incise the meatus to

the desired extent. The cut surfaces are dried with sterile gauze and then cauterized with the saturated solution of nitrate of silver in concentrated carbolic acid. The application should be made carefully so as to avoid smearing the solution in the urethra or on the penis. The excess is wiped away and then a similar application is made with Monsell's solution. While it is still moist with this solution the rubber band is removed and the part observed for a few minutes to see if there is any hemorrhage. In case there is it may be checked by applying again

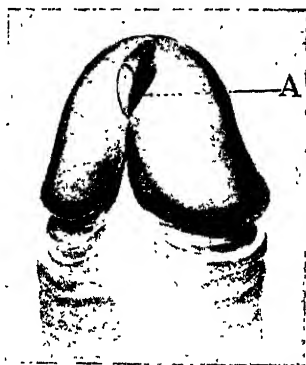


Figure 18.—Meatotomy. The incised surfaces have been cauterized to prevent their healing together and to lessen the pain on urination.

the Monsell's solution, and with digital pressure. No dressing or after treatment is required. The chief point to bear in mind is that the hemorrhage should be stopped before the silver-carbolic solution is applied. The extent of the subsequent contraction is less than that seen after the usual operation, but should be considered when making the incision which should be two sizes larger than desired. We wish to warn against the extensive incisions sometimes made, as we feel they are worse than useless, and increase the likelihood of subsequent infection.

**EXPLORATION OF THE URETHRA.**—The patient should be placed in a horizontal position. The penis, glans, and prepuce

should be thoroughly cleansed. The metallic instruments to be used should be sterilized by boiling in water containing 1% bi-carbonate of soda, or the sounds may be flamed, after dipping them in alcohol, or rendered sterile by immersing them in tall

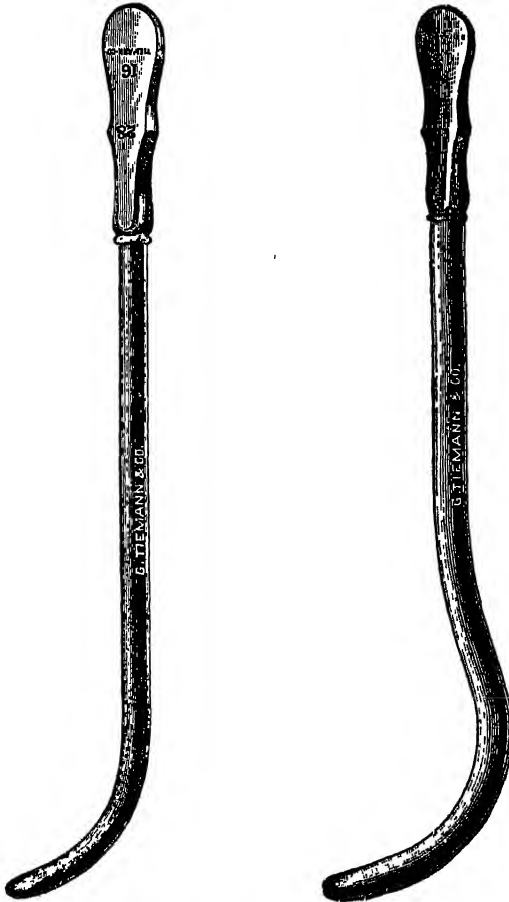


Figure 19.—Conical Steel Sound.

Figure 20.—Beneque's Sound.

bottles containing strong carbolic acid, and then rinsing them in sterile water. Certain varieties of gum catheters and bougies may be boiled, which of course is the surest way of rendering them sterile. Other catheters and bougies are kept in corked glass tubes



cotton saturated with formaldehyde. The instrument should be placed in a 2% solution of carbolic acid for five minutes to remove the formaldehyde before introducing it, to prevent the burning and irritation that otherwise would be caused. This simple method is equally as effective as the catharostats now on the market for the same purpose, and is much less expensive. All instruments should be well cleansed with soap and water and dried before being placed in the tubes.

A sterile sound, 18 to 20 F., should be introduced to prepare the way for the bougie, which should be several sizes smaller than the largest sound that will pass. In case such a sound will not pass, great care must be taken in introducing smaller metallic instruments, and in nearly all instances it is better and safer to use bulbous gum bougies when 15 F. cannot be introduced. The instruments and the urethra should be lubricated with sterile olive oil. After the blunt pointed sound has dilated the urethra, the bougie is passed to the obstruction and the distance from the meatus measured. If it will not enter, a smaller one is introduced beyond the stricture into the bladder, the length, tightness and tenderness of the stricture being noted, as well as other points of narrowing. After a moment the bougie is withdrawn slowly, while constricted points are again sought for; but it should be borne in mind that the posterior layer of the triangular ligament gives the sensation of a stricture. (White.) When the posterior part of the stricture is reached, this point is marked on the bougie, and by comparing the first measurement with the last the length of the stricture can be determined. The discharge brought out on the shoulder of the bougie should be examined under microscope to gain further information as to the condition of the canal. The "grasping" of the sound by a stricture is characteristic, and when once observed is not likely to be mistaken for anything else.

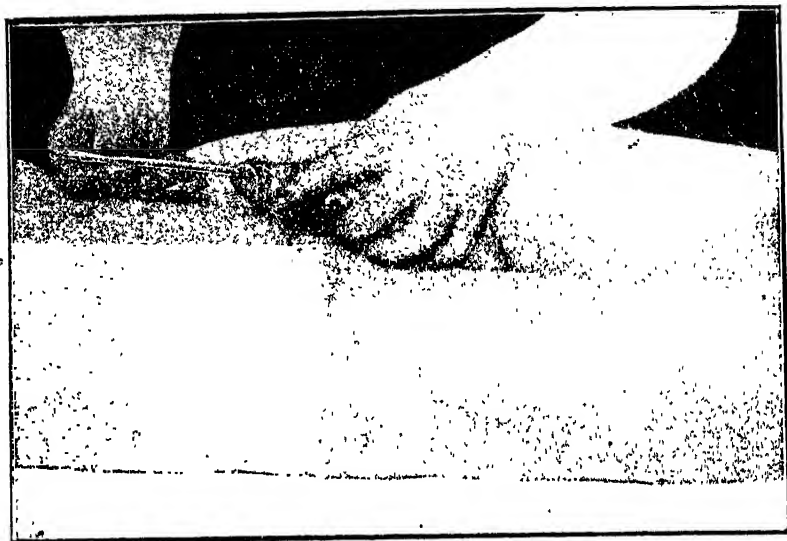
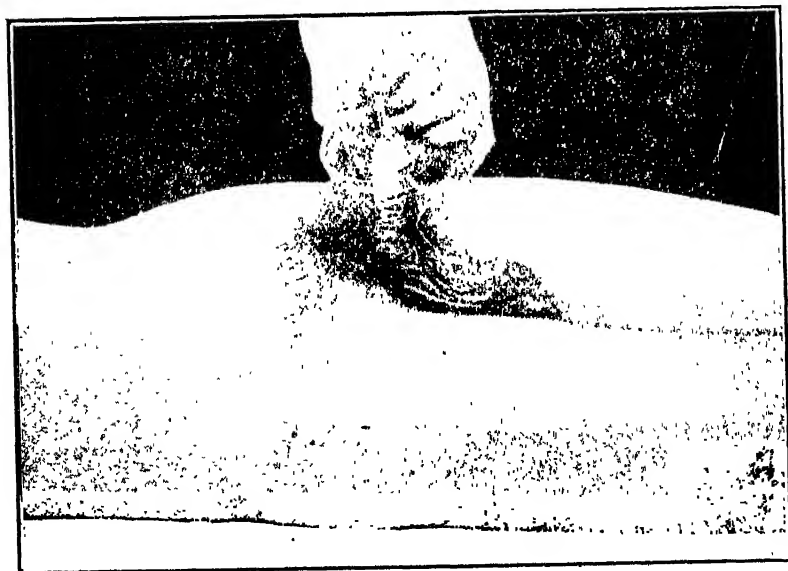


Figure 21.—Introduction of urethral sound.



Normal narrowings and granular or irritable patches, which cause contraction of the deeper muscles, may be misleading. When such is suspected, cocaine dissolved in tragacanth solution and glycerin injected ahead of the sound not only furnishes the desired anesthesia, but also lubricates the urethra, and tends to prevent or even overcome the muscular spasm.

R	Cocaine muriate -----	1.5	grs. xxiv
	Carbolic acid -----	1.3	m xx
	Adrenalin chlorid solution 1-1,000	2.	ʒss
	Glycerin .....	2.	ʒss
	Gum Tragacanth -----	1.3	grs. xx
	Water -----	q. s. ad 60.	ʒii

M.

THE PROGNOSIS.—Many factors have to be considered in making the prognosis of a stricture, as the duration degree of the contraction and complications, as well as the social condition surrounding the patient, and the kind of treatment indicated.

The condition of the bladder and kidneys are of the utmost importance in making the prognosis, as well as in selecting the treatment. The history of the case and the former attempts to cure it must also be taken into account.

In dilating a stricture a very important question is the stage of the transformation from the round-cell infiltration to cicatricial tissue. As a rule, the time required for a cure and its permanency varies according to the duration of the stricture. Suitable treatment of the inflammation at or behind the stricture, in order that the tissue can absorb more readily the infiltrate, will lessen the number of resilient strictures, while the same treatment, by healing the inflammation, will prevent many from becoming irritable and hemorrhagic.

The danger of incising a stricture and the liability of infection, fever, rigors, etc., increase with the depth of the coar-

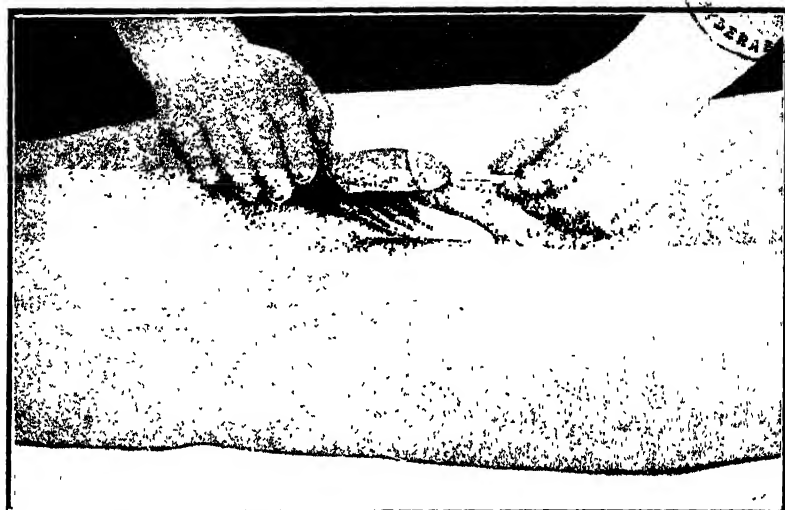


Figure 23.—A sound introduced into the bladder.



pass sounds or dilate at intervals in order to maintain the desired caliber, just as the same procedure is necessary in dilating gradually long standing strictures; these intervals may be greatly increased, however, after a proper course of treatment. Recent and soft strictures may be permanently cured by gradual dilation. Retention of urine, whether acute or chronic, increases the danger, and to a marked degree if an abscess or urinary infiltration results.

Occasionally, after urethrotomy, there is a curvature of the penis, which may persist for several months.

Fenwick found residual urine in a large percentage of organic strictures, and says that the presence of as much as 5 oz. should cause anxiety as to the effect of any intercurrent inflammation or disease, while 10 oz. should make one cautious in operating for stricture by internal urethrotomy and in giving anything but a grave prognosis as to the ultimate results.

**SUMMARY.**—Stricture of the urethra is a narrowing produced by a deposit of fibrous tissue caused by inflammation or traumatism. They are classified according to their various characteristics: linea, annular, tortuous; simple, irritable, elastic; soft, cicatricial; large and small. They are most frequently located in the bulbo-membranous region and in the first 6 c.m. ( $2\frac{1}{2}$  inches) of the urethra. Associated with stricture is usually an inflammation of the urethra, especially posterior to the constriction. If not relieved the bladder hypertrophies to overcome the retardation of the flow of urine, or may become gradually dilated with a thinning of its wall. The inflammation and dilation gradually involve the ureters and kidneys. The symptoms of stricture are gradual diminution in the size of the stream, a gleet discharge with pus and shreds in the urine, increase in the frequency of urination, dribbling after urination, difficulty in starting to void urine, sexual weakness and various

reflex pains and finally complete retention, sometimes rupture of the urethra or bladder with extravasation of urine. The diagnosis is easy if some of these symptoms are present and the Otis urethrometer or a bulbous bougie detects a narrowing in the canal. A meatus smaller than 23 F. should be incised, and the cut surfaces carefully cauterized with a saturated solution of nitrate of silver in carbolic acid, to prevent pain on urination; it also eliminates the necessity of subsequent instrumentation to prevent healing together of the incised surfaces. The prognosis depends upon the extent and duration of the stricture, and upon the gravity of the complications. It also depends upon the extent of the dilation and its continuation over a considerable time after the apparent cure. The Kollmann dilator enables one to secure much more lasting results than does dilatation with sounds.

## CHAPTER IX

## CONSTITUTIONAL TREATMENT OF STRICTURES.

THE CONSTITUTIONAL TREATMENT, SELECTION OF METHOD OF  
PROCEDURE, TREATMENT BY GRADUAL DILATION, IN-  
TRODUCTION OF SOUNDS, DIFFICULT CASES,  
KOLLMANN DILATOR,  
SUMMARY.

THE CONSTITUTIONAL TREATMENT.—In few diseases is a well ordered, temperate life so necessary as in the management of a stricture. Involvement of the kidneys requires that the duty imposed upon them be lessened as much as possible by a light nourishing diet, regulation of the bowels and the maintenance of a healthy condition of the skin by frequent bathing and friction; stimulants, especially effervescing drinks, as beer and champagne, highly seasoned food, cheese, cabbage, salt meats, strong coffee and all articles which tend to overload the urine should be avoided. (Bumstead & Taylor.) Moderate exercise, without over exertion or fatigue, is useful in maintaining the general health. A hot sitz bath just before retiring lessens the congestion of the pelvic viscera as well as spasm of the urethra.

Attention to the urethral inflammation is important, for it not only diminishes the danger of complications and relieves many of the symptoms, but also brings the tissues around the stricture into a more normal condition, thereby increasing their power to absorb the exudate. There are several methods which may be used with advantage by the surgeon in treating the inflammation. Some of which are hot irrigations; injections as in urethritis, and oil of sandalwood or urotropin; injecting the urethra with an oily solution or silver nitrate which acts as a lub-

ricant and at the same time medicates the canal; or by the introducing of sounds covered with solidified cocoa butter containing 1% to 2% nitrate of silver. A frequent mistake is made in waiting until the constriction is relieved before attempting to cure the inflammatory symptoms. The inflammation is a factor in depositing the infiltration that forms the stricture, and a continuation of the inflammation causes further increase in the infiltrate. The continued inflammatory action in the mucous membrane and follicles in front of the stricture has the same tendency to cause a narrowing in the canal that exists in any other chronic urethritis. It should be remembered that a vicious circle may be formed, the stricture keeping up an inflammation, and the inflammation adding to the existing stricture, and producing others. The best results follow when the canal is both dilated and medicated. The small quantity of urine that tends to remain behind the stricture and increase the inflammation should be gently but systematically massaged or milked out by the patient after urinating.

SELECTION OF THE METHOD OF PROCEDURE.—This often requires much “nicety of judgment,” for upon it and the attention to details largely depend the success of the treatment. The location of the stricture, its duration, density and caliber, the secondary damage already done, and the general health of the patient, with special reference to the condition of the bladder and kidneys, are all to be considered.

Strictures near the meatus must always be incised, as the abundant nerve supply makes an attempt at dilatation very painful, the tissues do not dilate and the result is always unsatisfactory. A medium size meatus without any symptoms referable to it should not be interfered with. Many patients are made more susceptible to subsequent infections and have the discomfort of spraying the urinary stream on account of,



perhaps, a useless operation for some ill-defined condition that a more careful surgeon might have recognized as due to some cause other than the narrow meatus. If there is inflammation and pouching of the canal just behind the meatus, meatotomy is indicated. Incision of the meatus is also necessary in the treatment of deeper strictures. Indiscriminate meatotomy, however, is to be condemned.

The consensus of opinion is that dilation is the safest and most efficient method of treating strictures, except those near the meatus, which should be cut. This rule may be applied to all permeable strictures. Those that are soft and recent can be cured permanently by this method. Dense, fibrous, inodular strictures are difficult to cure, if at all, by any procedure. It is usually advisable to attempt gradual dilation and incise the stricture later if necessary. Merely to incise a ring of fibrous tissue cannot cause its absorption. The cut portion heals by scar tissue which soon completes the circle, to be followed by further contraction. Attention to the general health, diet and hygiene will enable the surgeon to treat successfully nearly all strictures by gradual dilation, which undoubtedly is the safest method and at the same time furnishes the most permanent results. Do not be a partisan of any single method, but consider carefully the selection of the treatment for each individual case.

Internal urethrotomy may best be considered as a valuable adjunct to gradual dilation, for incision of an irritable or resilient stricture enables the surgeon to lessen the inflammation and to remove part of the deposit by passing sounds.

The best results from internal urethrotomy are seen in those cases in which the inflammatory deposit is engrafted upon a normal narrowing. According to our conception of the pathologic histology of strictures, it is impossible to see how ureters may be affected by internal urethrotomy, except in such a condition.

Internal urethrotomy of the deep urethra is dangerous on account of the excessive blood supply, poor drainage and abundant nerve connections. The deeper the stricture, the greater is the danger of internal incision, but deep strictures usually respond more readily to dilation than those in the penile urethra.

External perineal urethrotomy is indicated in those cases in which stricture of the deep urethra fails to respond to dilation or is irritable or resilient or complicated by abscesses or urinary infiltration, or in which inflammation of the bladder demands this operation in order to secure good drainage. External urethrotomy may also be advised when, after much patient work, a filiform has been introduced into the bladder; false passages may also require this procedure, and complete retention of urine with an impassable stricture always calls for external urethrotomy.

Some surgeons advocate external perineal urethrotomy for uncomplicated irritable or resilient strictures of the deep urethra. It is also of service in a certain number of cases where persistent dilation fails and the symptoms produced are of sufficient consequence to justify such radical measures.

Forcible dilation and divulsion are unsatisfactory and only in rare instances is the surgeon justified in adopting these methods. As the Kollmann dilator requires more skill and judgment than gradual dilation, it is deemed expedient to recommend that it be not used until after a certain amount of proficiency in the treatment of strictures with sounds has been acquired.

Continuous dilation is to be used only in cases where, with great difficulty, a filiform has been passed through a tight stricture or has been coaxed by a false passage. It may be left in the urethra twelve or twenty-four hours to insure the passage of other filiforms or a larger instrument and to star gradual dilatation later, or to act as a guide in o

ating. The floor of the urethra is usually the seat of false passages. Consequently, in introducing a sound the point of the instrument should always be kept well up against the superior wall (except at the meatus), which is the most fixed part of the urethra. If difficulty is experienced in passing the stricture, the urethra having been filled with oil, fine French or whalebone filiforms should be introduced. Many years ago Gouley recommended that false passages and depressions in the mucous membrane be filled with filiforms; by moving one after another the stricture can usually be entered. By dipping whalebone filiforms into hot water they may be bent as desired, and they will retain the shape when cool. The reticulation behind the stricture sometimes stops the filiform after the stricture is passed. If there is doubt as to the passing of the filiform again, one of several courses is open to the surgeon, according to the conditions, surroundings, and urgency of the symptoms. (The treatment must always be sufficiently radical to prevent inflammatory reaction from causing complete retention.) (1) the filiform may be left in place for twelve to twenty-four hours and gradual dilation instituted. A string is tied around it and fastened to a small strip of adhesive plaster, which is stuck on the shaft of the penis to prevent the filiform from slipping out. The question of the propriety of tying the filiform in the urethra depends upon the history of the stricture and the prospects of cure by this method. The urine will gradually pass along the filiform, so that even retention does not contra-indicate the adoption of this procedure. (2) An internal urethrotomy may be done in the anterior urethra, sounds being passed later to cause the absorption of the stricture. (3) An external urethrotomy is preferable to the latter suggestion where the symptoms are urgent, as in urinary infiltration, abscess, and severe cystitis with distention and back pressure affecting the kidneys. If the stricture is irritable

or resilient, a tunneled instrument may be passed over the filiform and the stricture divided. (4) Divulsion may be used in certain cases to relieve the urgent symptoms, followed by gradual dilation later. This plan should not be used unless there is some positive reason why the other more reliable methods should not be employed. In case a false passage is made the urethra should be irrigated and the patient kept quiet in bed, with light diet, bland drinks, and urinary antiseptics. No further attempts at instrumentation should be made for about three weeks, unless there is some distinct reason for interfering.

**KOLLMANN DILATOR:**—The Kollmann dilator affords means of dilating the urethra far superior to sounds. It requires, however, somewhat more of care than do sounds. Since the advent of the improved Kollmann dilator with the edges so beveled that they do not pinch the mucous membrane when being closed, the rubber cover formerly used is no longer necessary. This has greatly simplified the technic of such instrumentation. The instrument may be sterilized by boiling in water alkalinized with a small amount of caustic soda, or it may be flamed with alcohol and then placed in a tall bottle with a wide mouth containing a 1 to 2,000 solution cyanide of mercury.

The patient reclines upon an operating table and the penis is well cleansed as in the preparation for the passage of sounds. A sterile towel is placed around the penis and about 4 c.c. (5i) of automobile lubricating oil, containing gram 0.18 (grs. iii) of nitrate of silver to 30 c.c. (5i) is injected into the urethra to lubricate it and then the dilator is passed into the canal just as a sound would be introduced.

An instrument with a straight blade may be used for the anterior urethra, but one with a Beneque curve is necessary for the posterior part of the canal. The anterior urethra can, however, be dilated with the curved instrument. If difficult

is experienced in the introduction of urethral instruments, sounds should be used until the dilation has reached 23 to 25 French. After the Kollmann dilator is introduced it should be held steadily with the right hand while the left turns the handle until the desired dilation is obtained. The dial shows at every stage the exact extent of the stretching, in the French scale. The patient should be consulted in regard to the pain, and, after waiting one or two minutes, it should be screwed down and withdrawn in the same manner used in removing sounds. The urethra can thus be dilated much more easily, extensively and with less pain than with sounds; therefore, the results are proportionately more satisfactory and lasting. By exercising care nearly all urethras can be dilated to 38 to 45.

The treatment should be repeated about twice a week, taking the dilation one point higher each time and following the stretching with an irrigation of boric-carbolic acid solution as described in the chapter on urethritis.

When the limit of stretching seems to have been reached and perhaps a little bleeding follows the treatment, it should be discontinued for one or two weeks and then resumed with a drop of about five points in the dilation and gradually carried up as before. If the stricture is very dense and fibrous it is well to progress very slowly and go to the same point on several occasions, after considerable dilation has been obtained. The Kollmann dilator is the best friend of the man with a stricture. It is also of especial value in the treatment of certain forms of sexual weakness. There are few things more satisfactory in medicine than is the prompt improvement that frequently follows the dilation of the prostatic and membranous urethra to 40 or 45, whether there be a stricture or not. Alternated with endoscopic applications of nitrate of silver, as in the treatment of hyperemic and hyperesthetic conditions of the deep urethra and verumontanum, the Kollmann dilator again serves a valuable purpose.

After each treatment the instrument should be well washed and then dipped in alcohol containing a small amount of oil,

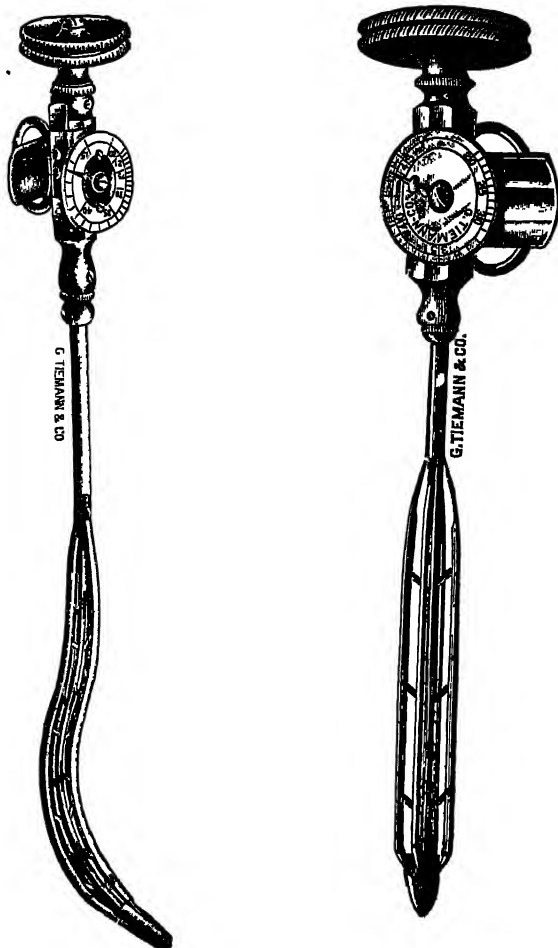


Figure 25.—Kollmann's Dilator for Antero-Posterior Urethra.

Figure 26.—Kollmann's Dilator for Anterior Urethra.

which is left on the instrument to prevent its rusting around the delicate joints, which, otherwise, would soon render it worthless.

Removal of strictures by caustics is purely of historic interest, as the constriction that followed the healing process was always worse than the original obstruction. Electrolysis has also been shown to possess little value. Total excision of inodular strictures has been done with success, but this operation is rarely required except in traumatic cases.

The theories of the changes which take place in a stricture which is undergoing gradual dilation have been varied and unsatisfactory. Most authorities agree that the pressure and stretching cause an absorption of a small amount of the tissue. From a study of the pathologic anatomy and the different forms of treatment of these cases it seems that stretching injures, by pressure on rupture, the most constricting fibers of the coarctation, and if the number of injured fibers and cells is small, they probably undergo necrosis preliminary to absorption. If, however, the damage is extensive, it is repaired by scar tissue just as is an injury to any other part of the body. The cicatricial tissue then contracts and defeats the very object we desire. This fact is clearly shown by the results which follow divulsion of the urethra or too rapid or rough dilation. Our object by gradual dilation is to make minute injuries of the constricting fibers or cells to cause them to undergo necrosis and to be absorbed, without doing sufficient damage to require repair by scar tissue. If the surgeon has a clear conception of the benefit that is thus to be derived from very gradual dilation, he will not be likely to produce an irritable, intractable stricture from one that, properly treated, would have been easily cured.

**TREATMENT OF STRICTURES OF THE URETHRA.**—The treatment by gradual dilation is the simplest, safest and most efficient method of treating strictures. It does more than dilate the constriction, it has the power of producing absorption of the inflammatory or fibrous deposit. A thorough ex-

amination should always be made, the condition of the kidneys, bladder, prostate, urethra, and the number, location and character of the strictures being noted. After this examination the urethra and bladder should be irrigated with a hot solution of boric acid or weak solution of potassium permanganate. During the first day or two following the dilation there is sometimes a temporary exacerbation of the symptoms with an increase in the discharge and shreds. During this period no sounds should be passed until the inflammation has subsided.

An irrigation may be given daily, between treatments with the sounds, when the urethra is inflamed. The largest sound that was easily passed at the first examination should again be introduced on the 3d, 4th, or 5th day, and the size increased one number of the French scale at each subsequent treatment.

INTRODUCTION OF SOUNDS.—The glans penis and especially the region around the meatus, should be well cleansed with 1-3000 bichloride of mercury solution, and a sterile towel placed around the penis. The canal should be partially filled with a 1-8% solution of nitrate of silver in medium lubricating oil as is used on automobiles. This should be sterilized by boiling or in the autoclave. This is a better lubricant than liquid albolene and easier to apply than vaseline. The oil is injected with a sterile blunt pointed urethral syringe, after which the meatus is compressed between the fingers of the left hand to prevent the escape of the oil before the sound enters. By this simple method the sound can be passed easily, at the same time the canal and all its folds are medicated. The glans penis is held in the left hand, and the instrument in the right. The sound is gently introduced, its shaft being held parallel with the line of the patient's groin until a slight obstruction is detected; it is then carried toward the midline



and close to, but not touching, the abdomen. The index finger and middle finger of the left hand are now transferred to the perineum, where by slight pressure they direct the point of the sound into the membranous urethra, as the shaft of the instrument is raised from the abdomen and carried toward the patient's feet. After it has passed part of the way through the deep urethra the left hand grasps the sound and depresses it, while the thumb and index finger of the right press down on the symphysis at each side of the root of the penis. Occasionally the compressor of the urethra will not relax and allow the passage of medicated oil, which causes distension in the urethra. In such cases the sound should be withdrawn and part of the oil allowed to escape.

The sound may be left in the canal from 1 to 3 minutes and then removed in just the reverse of the order in which it was introduced.

The progress is more rapid at first in strictures of small caliber, but becomes slower as the canal becomes more nearly normal. Generally speaking, the more abnormal the constricting tissue, the more successful is the dilation. By carefully following the above plan of treatment, all the urinary and sexual functions rapidly improve, and lingering gleet is rarely encountered after the constriction is removed. Nitrate of silver or other drugs may be dissolved in the oil as may be indicated for the case in hand.

When in the course of treatment the limit of stretching seems to have been reached, a sound 3 or 4 sizes smaller should be passed at the next treatment, or the extent of the dilation with the Kollmann should be limited to 5 or 6 points smaller and the interval of a week allowed to elapse, and the size gradually increased at subsequent treatments. This dropping back to smaller sounds may be repeated a number of times, and is more effective in causing the absorption of the stricture than if the larger sizes were introduced each time.

After the normal caliber has been attained the instrument should be passed about once a month for perhaps a year or longer to prevent subsequent contraction. Few complications will ever be caused if due regard is paid to gentleness and cleanliness. Patients living in districts remote from the surgeon, and who have well marked fibrous strictures, should be furnished with a sound at the end of the treatment, and be taught how to sterilize and pass it on themselves. They should also have explained to them the importance of doing this in a regular systematic way as soon as the slightest symptoms of a recurrence appears.

DIFFICULT CASES.—Eccentric openings, tortuous strictures, and false passages are the most frequent cause of the failure of competent surgeons to pass instruments. The infiltrate being usually most marked in the lower urethral wall and the looseness of this segment of the canal make it the most frequent seat of false passages. Consequently, on introducing a sound the point of the instrument should always be kept well up against the superior wall (except at the meatus) which is the most fixed part of the urethra. If difficulty be experienced in passing the stricture, the urethra having been filled with olive oil, fine, small silk catheters or whalebone filiforms should be introduced. Many years ago Gouley recommended that false passages and depressions in the mucous membrane be filled with filiforms; by moving one after another the stricture can usually be entered. By dipping whalebone filiforms into hot water they may be bent as desired, and will retain their shape when cool. The reticular folds behind the stricture sometimes stop the filiforms after the stricture is passed. Kummel has introduced fine probes, through the endoscope after other methods had failed. If there is doubt as to the passing of the filiform again, one of several courses is open to the surgeon, according to the conditions, surroundings and urgency of the symptoms. (The treat-

ment must always be sufficiently radical to prevent inflammatory reaction from causing complete retention.) (1) The filiform may be left in place for twelve to twenty-four hours and gradual dilatation instituted. A string is tied around it and fastened to a small strip of adhesive plaster, which is stuck on the shaft of the penis to prevent the filiform from slipping out. The question of the propriety of tying the filiform in the urethra depends upon the history of the stricture and the prospects of a cure by this method. The urine will gradually pass along the filiform, so that even retention does not contra-indicate the adoption of this procedure. (2) An internal urethrotomy may be performed in the anterior urethra, sounds being passed later to promote the absorption of the stricture. (3) An external urethrotomy is preferable to the latter suggestion where the symptoms are urgent, as in urinary infiltration, abscess, and severe cystitis with distention and back pressure affecting the kidneys. If the stricture is irritable or resilient, a tunneled instrument may be passed over the filiform and the stricture divided. (4) Divulsion may be used in certain cases to relieve some of the urgent symptoms, followed by gradual dilatation later. This plan should not be used unless there is some positive reason why the other more reliable methods should not be employed. In case a false passage is made, the urethra should be irrigated and the patient kept quiet in bed, with light diet, bland drinks, and urinary antiseptics. No further attempts at instrumentation should be made for about three weeks, unless there is some distinct indication for interfering.

SUMMARY.—A well ordered and temperate life is necessary in the management of a stricture. Attention to the urethral inflammation is required in addition to dilatation or cutting. In selecting the method of procedure we should remember that the majority of strictures are best treated by gradual dilation, except when very near the meatus. Congenital strictures

should be incised as we have normal tissue to dilate and do not obtain the same satisfactory results that follow the dilatation of an ordinary stricture. External perineal urethrotomy is indicated in those cases in which stricture of the deep urethra fails to respond to dilation, or if serious complications as extravasation of urine occurs. Complete retention of urine always calls for this procedure. The stretching by gradual dilation injures by pressure or rupture the most constricting fibers, and if the damage is small they undergo necrosis preliminary to absorption. If, however, the injury is extensive it is repaired by scar tissues and thus defeats the very object we desire. Therefore let us remember that it is GRADUAL dilation that is required. Equally important are cleanliness and gentleness. The canal should be lubricated by injecting sterile oil, instead of depending upon lubricating the instrument. Dilations may be repeated in from two to five days. In difficult cases where instruments cannot be inserted, whalebone filiforms should be introduced as deeply as possible, and then others passed, until by successively moving one after another the stricture is passed. In such instances the filiform may be followed by a tunneled sound, or it may be tied in place for 24 hours; the urine will dribble by the filiform so that even retention does not contraindicate the adoption of this procedure. The Kollmann dilator affords means far superior to sounds in securing full and lasting dilation of the urethra; the results are, therefore, more satisfactory, though more care and experience are necessary. These dilations also are of decided value in the treatment of sexual weakness and impotence.

## CHAPTER X

OPERATIVE TREATMENT OF URETHRAL  
STRICTURES

INTERNAL URETHROTOMY, EXTERNAL PERINEAL URETHROTOMY,  
THE WHEELHOUSE OPERATION, COCKE'S OPERATION,  
COMPLICATIONS OF STRICTURE, EXTRAVASA-  
TION OF URINE, ABSCESS AND FIS-  
TULA, TREATMENT AND  
SUMMARY.

INTERNAL URETHROTOMY.—This operation has a mortality of about 2%, which increases with the depth of the stricture. This danger, though slight, should always be remembered in deciding upon the procedure. The condition of the kidneys, bladder and urethra should be made as nearly normal as possible by a few days' or a week's preliminary treatment, the urine being rendered bland and less infectuous by the administration of urinary antiseptics and diuretics.

The urethra should be irrigated and anesthetized with a 2% to 4% solution of cocaine in distilled water; or in a somewhat stronger solution, in tragacanth and glycerin injected ahead of the sound. A general anesthetic is rarely necessary.

The various instruments that have been devised for this operation will not be discussed, but the one with which the operator is most familiar is usually desirable. The caliber of the stricture is also a factor to be considered in selecting an instrument, for if the constriction is very tight, a Maissonneuve, (or Gouley's small tunneled urethrotome) to follow a filiform, is necessary to enlarge the canal enough for the passage of a larger urethrotome. The Otis-Wyeth instrument is very satis-

factory and is to be introduced until the point from which the blade will emerge is well behind the stricture. The incision should be made in the roof of the canal in the median

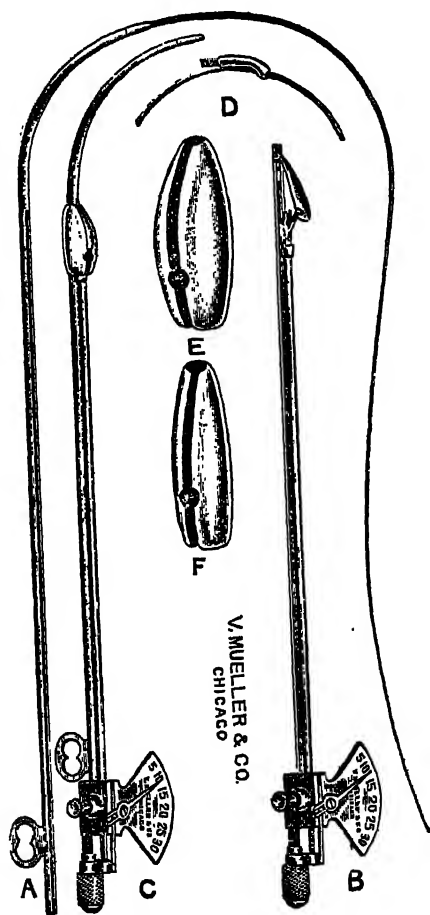


Figure 27.—H. McC. Young's New Urethrotome: A, grooved staff; B, cutting apparatus; C, cutting apparatus inserted into grooved staff and olive adjusted; D, extra tip for introduction over a whalebone bougie; E and F, olives.

line, after dilating until the tension of the stricture is felt. The blade is now brought forward firmly and steadily, cutting entire stricture and for a small distance in front and behind.

The blade is replaced, the urethrotome removed and the bulbous bougie passed to determine if all the stricture is cut. If a narrowing is still present the operation should be repeated. A sound is passed finally to insure patency of the canal.

H. McClure Young has devised a most ingenious urethrotome. He describes as follows his technic: "First, the surgeon will pass the grooved staff down through the stricture; he will then hold it firmly by the little handgrip between the thumb and index finger of the left hand. Then, with his right hand he will pass the cutting apparatus, olive adjusted and knife lowered, down along the staff until he meets an obstruction. This will indicate that his olive lies directly against the face of the stricture, and that he may now proceed to elevate his knife. This having been done he will advance his cutting apparatus farther until resistance ceases or becomes greatly diminished, when he will lower his knife again. Now he will advance his cutting apparatus farther with the knife concealed, thus testing the entire urethra with his olive, and bringing his knife into action only when cicatricial tissue is encountered. He may enter the bladder if he chooses. The olives, being tapering, have no shoulder to catch at any point. Finally, the cutting apparatus is withdrawn, as it was introduced, with the knife lowered and protected by the olive.

"The surgeon may now exchange his olive for one of larger size and repeat his maneuvers, this time placing his incision somewhat laterally to the original one, according to the method of Guiard. This may be done again and again, until he has brought the urethra up to such size as he may elect, and then, and not till then, will he remove the grooved staff.

"It will be seen that with this instrument the surgeon is enabled to place his incisions with great accuracy, sparing absolutely the sound urethra and dividing beyond peradventure all strictured areas."

The hemorrhage is usually not severe after internal urethrotomy, and may be checked by pressure on the penis at the



Figure 28.—Otis' Dilating Urethrotome.

point of incision or by cold applications. If necessary, a catheter may be passed and pressure applied around it until the hemorrhage is checked.

On leaving the patient, the surgeon may order a suppository as follows:

R	Extr. opii. -----	.06	gr. 1
	Extr. hyoscyam. -----	.03	gr. $\frac{1}{2}$
	Extr. belladon. -----	.015	gr. $\frac{1}{4}$
M. et ft. suppository, No. 1.			

This allays pain and lessens the danger of a chill.

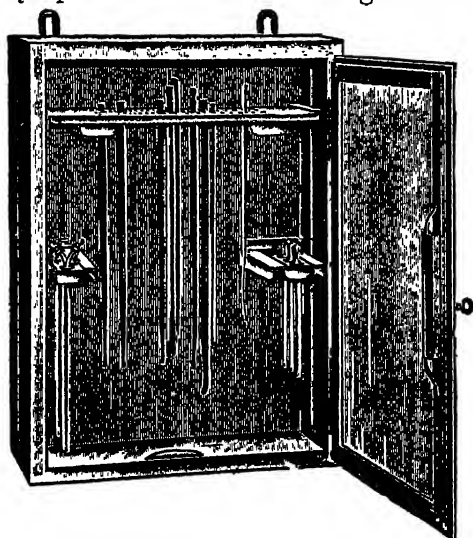


Figure 29.—Hagan Formalin Sterelizer for Catheters, Endoscopes and Cystoscopes.



The patient should remain quiet in bed for several days on a light diet and partake freely of diluent drinks.

On the third or fourth day, if there is no hemorrhage, a Kollmann dilator or sound should be passed and reintroduced until all adventitious tissue has been absorbed or stretched sufficiently to obviate further contraction. The intervals between dilations should be increased until a treatment is given only once every month or two, and continued for about 5 to 12 months, and even longer if indicated.

**EXTERNAL PERINEAL URETHROTOMY.**—Celsus described directions for this operation as applied to calculi; Rhazes, during the tenth century, and Avicenna, during the eleventh, are referred to as speaking of an incision into the urethra through the perineum for relief of retention of urine.

This is the method of treatment to be resorted to when the simpler methods fail or when there are complications, as an abscess or urinary infiltration, or when an infection of the bladder necessitates drainage. It is also safer than internal urethrotomy when the stricture is located in the deep urethra. Where the symptoms refuse to yield to dilation good results may be obtained by external perineal urethrotomy. The operation is comparatively easy to perform if a grooved catheter or sound, or even a filiform, can be passed into the bladder.

The rules of Syme are: "Be positive the guide penetrates the stricture and enters the bladder, especially if false passages exist. Take care not to deviate the incision from the median line, and in this way avoid blood vessels. Keep the edge of the knife mainly upward to avoid opening the posterior layer of the perineum with consequent danger of infiltration of urine. Insert the point of the knife posterior to the stricture and incise it by cutting from behind forward in the groove of the guide. Use a grooved director to aid the passage of the

instrument into the bladder if difficulty is encountered without a guide."

Of more difficulty and danger are the cases where no instrument can be passed into the bladder. This attempt should be made, however, after the patient is anethetized, as the muscles thus may be relaxed so that the instrument will pass, although it could not be introduced before. If this fails after a careful, patient attempt, the method suggested by Penn of using a large curved trocar to puncture the bladder just above the symphysis pubis should be used and retrograde catheterization done through the trocar with a blunt-pointed instrument having the same curve as the trocar. This finds the dilated canal posterior to the stricture, and by using, in addition, an instrument in the anterior canal down to the stricture, it can be incised and the bladder reached without much difficulty.

In case urinary infiltration and perineal abscesses and fistulae are extensive, it will be better to make a suprapubic puncture with a trocar and insert a catheter as previously described until the perineal region becomes more normal, which it will do in a few weeks. If the bladder walls have become so thickened by the constant overwork in overcoming the back pressure and its cavity markedly diminished in size, the suprapubic puncture for retrograde catheterization or insertion of a catheter may not be feasible. In such an instance a suprapubic incision should be made into the bladder, carefully retracting the peritoneum, and a tube inserted for drainage. Resection of the fibrous masses of stricture can be more expeditiously done after some such drainage when the adventitious tissue is less abundant and the perineum is more normal. Urethrectomy has been advocated by Koenig, Roncet, Heuser, Moliere and others. Guyon excised the lower segment of the narrowed urethra, which he claims is usually the site of the stricture and closed the catheter in the urethra with se

layers of tissue. The roof of the urethra provides mucosa from which epithelium may proliferate and cover the new urethra.

**THE WHEELHOUSE OPERATION.**—A sound is introduced down to the stricture and then turned around so that the point projects into the perineum; an incision is made down to the end of the sound and the urethra is opened in front of the



Figure 30.—Rand's Tunneled Knife for incision of stricture.

stricture. Ligatures are placed in the urethral flaps on each side, the bleeding vessels are clamped and, after sponging the wound dry, a small probe or director is passed through the stricture, which is cut from before backward. The finger should then be introduced into the bladder to determine if all the obstruction is relieved.



Figure 31.—Teale's Probe-Pointed Gorget.

**COCK'S OPERATION** of external perineal urethrotomy without a guide, should be employed rarely as it is the most dangerous of the various methods of perineal section. The index finger of the left hand is introduced into the rectum. A scapel with a long, narrow blade is then thrust into the median line of the perineum, about an inch in front of the anus, and carried anterior to the finger in the rectum in the effort to open the urethra just at the apex of the prostate.

**THE AFTER TREATMENT OF PERINEAL URETHROTOMY** is the same, whether done with or without a guide. The hem-

orrhage is usually not severe if the incision is kept strictly in the midline. The bleeding may be checked by clamping and tying spurting arteries and by applying pressure with gauze to stop the oozing. The urethra, wound and bladder should be irrigated with a hot saline solution.

A catheter left in the urethra affords a very satisfactory method of drainage, unless irritation and erections are provoked, and, as a rule, these will not produce any trouble.

The distal end of the catheter is allowed to project into a urinal placed between the patient's thighs. This once almost obsolete method of bladder drainage again seems to be coming into more general and apparently deserved use. The perineal wound should be brought partially together by sutures of cat gut or silkworm gut and then packed with iodoform gauze.

If thought preferable to the catheter in the urethra the surgeon may pass a full size catheter into the bladder through the perineal wound and stitch it in place for drainage. In this latter method iodoform gauze should be packed around the catheter, only one strip being used to facilitate its removal. A dressing of sterile gauze and cotton is then applied and held in place with a "T" bandage. When the patient is placed in bed the catheter projecting from the perineal wound is connected to a long tube leading to the receptacle for urine, hanging by the bed.

If pain is severe, a hypodermic of morphine, gr.  $\frac{1}{4}$  and atropine, gr. 1-150, may be administered. If the renal function is sluggish, 2 grs. of spartein sulphate should be given hypodermically every 6 hours. McGuire has called especial attention to the value of this drug as a kidney stimulant, and we have found it of distinct value. An abundance of water should be taken by the patient, and urotropin given if there is any bladder infection.

The bladder should be irrigated once or twice daily with a hot boric acid or saline solution, as long as there is evidence of cystitis and bladder irritation.

The gauze packing may be taken from the wound after 24 to 36 hours and need not be replaced. The nurse or attendant must be warned to look carefully for indications of hemorrhage.

The urethral catheter should be removed in 6 to 8 days and a sound introduced 3 to 4 days later and then dilation once or twice a week for a month with a Kollmann. The intervals should be increased gradually and the sounds continued as long as there is any tendency to contraction. The perineal drainage tube should be withdrawn on the 5th or 6th day and the patient allowed to be out of bed. Full size sounds should be introduced to make sure the canal provides free passage of urine, which will soon flow through the urethra and allow the wound to heal. This may be hastened by touching the wound occasionally with nitrate of silver.

COMPLICATIONS.—Urethral fever is not well understood and is confused with various diseases, as septicemia, pyemia, uremia, etc. The cause remains yet to be discovered, and there is much diversity of opinion in regard to the matter. Keyes thinks the following points are well established: (1) That the deeper the operation, the more likely urethral fever is to follow; (2) operations near the meatus rarely cause it; (3) overstretching a stricture without rupturing it is more apt to cause urethral fever than when it is divulsed or cut; (4) one attack does not predispose to another; (5) other things being equal, it is more likely to occur in patients with fever or those with very nervous, impressionable temperaments; (6) organic kidney disease makes urethral fever more likely to occur and to be fatal; hence the importance of always examining the

urine for albumin and casts; (7) urethral fever cannot be ascribed to urinary absorption.

This last point is emphasized as the essential cause by Lydston and Reginald Harrison.

The symptoms vary from slight nervous chill, followed by fever, malaise, etc., to the profound collapse or surgical shock, with great depression, anuria, uremic symptoms, perhaps with high fever and septicemia. Cases of real toxemia or septicemia cannot properly be classed under this heading.

The treatment is largely prophylactic. Severe septic and uremic cases may be fatal in spite of treatment. Preliminary preparations are important; rest in bed for two or three days, and flushing the entire genito-urinary system with diluents and urinary antiseptics, as well as thorough irrigations of the bladder and urethra, are to be advised. The presence of casts and albumin always necessitates additional care. Medical treatment is symptomatic.

Retention of urine is likely to occur in patients with stricture after excessive indulgence in food, stimulants and coitus.

The treatment depends upon many conditions, but generally may be begun with a hot sitz bath and hot fomentations to the lower abdomen and perineum. If these fail 60 c. c. (5ii) of sterile glycerin should be injected through the urethra into the bladder and the urethra held so as to prevent the escape of the glycerin until the patient has an urgent desire to urinate. This is not long delayed, and unless there is a tight pathologic narrowing he will promptly empty his bladder. (This is preferable to catheterization in post-operative retention.) In case this method is unsuccessful, catheterization should be tried, and if this fails, aspiration should be done through the space of Retzius. This may be repeated with safety for a number of times until the immediate cause can be removed, or until the patient's condition improves and will permit of more radical measures.

**EXTRAVASATION OF URINE.**—Violent straining efforts to empty the bladder may cause a rupture of the weakened and dilated urethra, with an outflow of urine into the tissues. If the amount is small it may result in an abscess, but if extensive, extravasation of urine follows, and may cause widespread sloughing and gangrene and the formation of numerous fistulae.

The course of extravasated urine depends upon the location of the rupture. The symptoms usually begin during retention of urine, and while straining, the patient feels "something give way," and there is momentary relief. This is immediately followed by a burning pain in the perineum, penis and later in the scrotum and abdomen, which are involved if the rupture is near the bulb. A black spot on the penis means the infiltration has involved the corpus spongiosum, and Brodie gave it as an invariably fatal sign.

Extensive gangrene of the scrotum and perineum may cause large surfaces to slough away. The prognosis is always grave where the extravasation is extensive.

**TREATMENT.**—This consists in thoroughly removing the obstruction and making a free incision, except on the penis, where conservatism is necessary. The urine should be squeezed out and the parts irrigated with hot solution of bichloride and packed with iodoform gauze. The patient should be kept absolutely quiet, and stimulated as needed.

**ABSCESSSES AND FISTULAE.**—An abscess may start in the urethral wall from infection in a follicle or a duct, or from the urine being forced through a weakened point in the mucous membrane. The abscess thus formed finally ruptures externally (sometimes internally) and results in the formation of one or more fistulae, which occasionally are very numerous, but have a single opening into the urethra.

**TREATMENT.**—If of recent formation they are usually cured by removing the obstruction to the flow of urine and by touching with stimulating solutions. If this plan fails, incision of the external opening down to the urethra should be made and the wound encouraged to heal from the bottom. A catheter should be tied in the urethra and no urine allowed to flow through the fistula until it has healed.

**SUMMARY.**—Before internal urethrotomy is done all phases of the local condition should be considered as well as the patient's health, with especial reference to the kidney function. A general anesthetic is unnecessary for internal urethrotomy, 2% to 4% of cocaine being sufficient. The incision should, as a rule, be made in the roof of the canal in the median line except at the meatus. Care must be taken to incise all of the stricture so that there is no longer any binding when a sound is introduced. The hemorrhage may be checked by pressure, cold applications or a bandage applied after the introduction of a fairly stiff catheter. Copious ice cold irrigations of physiologic salt solution are useful in checking urethral or bladder hemorrhage.

External perineal urethrotomy is comparatively easy to perform if a grooved instrument, or even a filiform, can be introduced into the bladder as a guide. Prolonged but gentle effort, therefore, is necessary before attempting to operate upon difficult cases. If nothing can be passed through the urethra, retrograde sounding should be done through a curved trocar inserted through the space of Retzius to find the dilated portion of the canal posterior to the stricture. This is simpler and less dangerous than if done through a supra-pubic incision into the bladder; it is also less dangerous than Cock's operation. The Wheelhouse operation may be tried if preferred. An incision is made through the perineum to the end of a sound, which has been passed down to the stricture, and the urethra is



opened; ligatures are placed in the flaps, bleeding vessels are secured, and after sponging the wound dry, a small director is passed and the strictures incised. Hemorrhage is checked by clamping, tying and pressure; a hot saline irrigation of the bladder is given and a catheter is left in the urethra for drainage, or if desired through the incision into the bladder. A small gauze drain is packed in the incision which is then closed around the drainage tube. The gauze is removed in 36 hours and the catheter or perineal tube in a week or eight days.

## CHAPTER XI

## PROSTATIC DISORDERS

ANATOMY, CLASSIFICATION, ACUTE PROSTATITIS, ETIOLOGY, PATHOLOGY, SYMPTOMS, EXAMINATION, DIAGNOSIS, ABSCESS OF THE PROSTATE, PROGNOSIS, PERI-PROSTATITIS, TREATMENT, AND SUMMARY

Its situation around the deep urethra, into which it opens by twenty to thirty ducts, makes of the prostate gland a most favorable nidus for lingering infections. It is, in fact, a deep seated focus of infection in nearly all the chronic urethral affections. A thorough knowledge of the anatomy, physiology and pathology of the prostate is one of the most important factors in the successful management of gonorrhoea. The history of the symptoms, as a rule, should be disregarded, and a thorough examination made, even if there be only slight evidence, or even none to suggest it is the seat of an existing chronic urinary or sexual disorder. Acute prostatitis is more frequently and more readily recognized than the chronic type. The enlargement and tenderness make it easily diagnosed by rectal palpation, but it may be mistaken for acute cystitis or urethro-cystitis, unless such an examination is made. Where there is much prostatic inflammation, the deep urethra, the neck of the bladder and contiguous portions of the bladder are more or less involved. A name that accurately describes the condition is urethro-cysto-prostatitis.

ANATOMY.—The prostate gland appears about the third month of fetal life as two small thickenings on the posterior wall of the deep urethra. About the fifth or sixth month these nodules coalesce around the urethra. At birth the prostate is a bi-lobed organ. Numerous follicles develop in each lobe and

open into the urethra on either side of the verumontanum, which is a small protuberance on the floor of the posterior urethra through which pass the two ducts from the seminal vesicles. Generally speaking, the prostate may be considered as consisting of two lobes, although, as the gland develops later in life, the portion lying between the urethra and the ducts of the seminal vesicles seems to form a third or a median segment, which Deaver has more appropriately called an accessory lobe. The prostate is very small during childhood, but at puberty there is a rapid development of the glandular portions. The prostate in an adult is the shape of a "horse chestnut," its apex running forward along the urethra. Like other genito-urinary organs it varies much in size as well as in shape. It weighs from four to six drachms and the average antero-posterior diameter is about one and one-fourth inches, the transverse, one and a half inches, and the vertical, three-fourths of an inch. It is a compound tubular gland. The glandular acini are imbedded in a mesh-work of involuntary muscles and connective tissue, the latter being connected with the prostatic capsule and closely bound to the gland substance. Outside of this is a less firmly attached layer of fibrous tissue called the sheath; in it is found the venous plexus. The slightly depressed portions of the urethra into which the ducts empty on each side of the verumontanum are called the prostatic sinuses.

The urethra passes through the prostate, anterior to its central axis, and, as a rule, there is no glandular tissue in front of the urethra. The prostate is about half an inch behind the lower margin of the symphysis pubis and around the neck of the bladder, which binds it above; the rectum is below and separated from the prostate only by the mucosa and a thin layer of connective tissue. The veins of the prostate are derived mainly from subdivisions of the dorsal veins of the penis, a few small branches coming from the gland and from the sur-

rounding muscles. The arterial supply is from the vesico-prostatic artery, from the internal-pudic and from the middle hemorrhoidal branch of the inferior vesical arteries. None of them is large.

Deaver says the nerves are largely derived from the sympathetic system, through the pelvic or inferior hypo-gastric plexus, some medulated fibers also being found. The bladder, urethra, and cavernous tissue of the penis also receive their nerve supply from the same source. Thus reflex pains that occur at the head of the penis in prostatic and bladder affections are accounted for. The secretory fibers of the prostate are derived from the sacral plexus.

## CLASSIFICATION OF PROSTATIC DISEASES

<i>Acute Prostatitis</i> -----	<div> <div></div> <div>Follicular.</div> <div>Interstitial.</div> </div>
<i>Peri-Prostatitis.</i>	
<i>Abscesses of the Prostate</i> ---	<div> <div></div> <div>Follicular.</div> <div>Interstitial.</div> </div>
<i>Sub-Acute Prostatitis.</i>	
<i>Chronic Prostatitis</i> -----	<div> <div></div> <div>Catarrhal or Parenchymatous.</div> <div>Interstitial.</div> <div>Atrophic.</div> <div>Hypertrophy.</div> </div>
<i>Sub-Chronic Prostatitis.</i>	
<i>Neurosis of the Prostate.</i>	
<i>Hypertrophy of the Prostate</i> —	Many sub-varieties.
<i>Tuberculosis of the Prostate.</i>	
<i>Carcinoma of the Prostate.</i>	
<i>Sarcoma of the Prostate.</i>	
<i>Syphilis of the Prostate.</i>	
<i>Cysts of the Prostate.</i>	
<i>Calculus of the Prostate.</i>	

ACUTE PROSTATITIS.—Acute protatitis may be follicular or interstitial; when the inflammation is limited largely to th

follicles and their lining it is termed follicular prostatitis. The gland is not much enlarged, but considerable pus may be expressed from it. When the stroma of the gland becomes inflamed, it is called interstitial prostatitis, and there is much swelling and pain. These two varieties always coexist to some extent. The line of demarcation between acute and subacute prostatitis is not well defined from a pathological standpoint, but is mainly chronologic. A much prolonged and acute condition is properly classed subacute, while the very persistent subacute is merged into the chronic.

**ETIOLOGY OF ACUTE PROSTATITIS.**—Gonorrhoeal infection is by far the most frequent cause of prostatitis; next comes infection from unclean instruments, and especially is this likely to follow when traumatism has been produced by their rough or unskillful introduction. During an acute attack of gonorrhoea the passage of urethral instruments, no matter how carefully done, is likely to set up an acute prostatitis. Alcoholic and sexual excesses and muscular exertion are always likely to carry the urethral inflammation into the prostate. The same may be said of long walks, tennis and of bicycle and horseback riding. Acute prostatitis has also been reported occasionally in such systemic diseases as scarlet fever, smallpox, typhus fever, pyemia, pneumonia, etc. These systemic affections cause an interstitial prostatitis, with a uniform enlargement of the gland, while the follicular variety arises from an infectious urethritis.

**PATHOLOGY.**—The prostate may become hard and uniformly enlarged, as much as two to four times its normal size, or the infiltration may be limited to one side or to a few follicles, or to the verumontanum. This limitation is much more frequently seen in chronic inflammation. The secretion expressed from the prostate contains pus, proteid, mucus, organisms, phosphates and desquamated cells. The swelling around the ducts

of the follicles may prevent the escape of this secretion and thus may originate an abscess. The prostatic tissue becomes swollen, and there follows a roundcell infiltration, very similar to that found in the submucosa of the inflamed urethra. Resolution may take place more or less slowly and finally leave the gland nearly normal, or induration may remain in the form of nodular masses, or there may be uniform enlargement.

**SYMPTOMS.**—The symptoms of follicular and interstitial prostatitis are very similar, but usually are more severe in the latter. The intensity varies very greatly, from those mild in character, with only an increase in the frequency of urination and a little pain at the end of the act, to those with the severe symptoms given below. There may be a feeling of general malaise, with a chilly sensation, or a distinct chill followed by rise in temperature. The desire to urinate is urgent and frequent, and considerable straining may be required to void the urine, as the canal is encroached upon by the swollen gland. This swelling at times causes complete retention. Blood may appear as a terminal hematuria or in pollutions. In the severe cases there is pain, throbbing in character, in the perineum, lumbar region, or in the rectum, perhaps made worse by straining at stool. An abscess may occur, with augmentation of these symptoms until it is incised or ruptures. The urine is cloudy in the three glasses. The discharge from the meatus generally diminishes during the acute stage, but returns when the prostatic inflammation subsides.

**EXAMINATION.**—By rectal palpation one may feel a hard, enlarged, hot, tender gland, from which may be pressed a small quantity of pus. Force should never be used in these examinations, for both the rectal and urethral sphincters are so irritated by the proximity of the inflammation that the danger of retention of urine is increased and the examination is made more

difficult. Rarely will there be any doubt as to the diagnosis, but there may be some uncertainty as to the presence of an abscess. The gland should be examined for soft foci of supuration.

THE DIAGNOSIS.—During a specific urethritis, indiscretions or excesses of any kind, followed by increased frequency of urination, and perhaps hematuria, with or without pain in this region, should always suggest the possibility of prostatitis. Pain, increased during defecation and throbbing in character, attended with a feeling of indisposition, chills and fever, increase the likelihood of the existence of such a condition. A rectal examination confirms the suspicion when a hard, enlarged and tender gland is found.

Acute posterior urethritis gives symptoms very similar to acute prostatitis, but the gland will not be enlarged and hard. The other symptoms are urinary rather than rectal and perineal.

Cowperitis also must be eliminated in making a diagnosis. It occurs as a sensitive swelling anterior to the prostate on one or both sides of the median line, immediately below the lower border of the symphysis pubis.

THE PROGNOSIS, generally speaking, may be considered good, but there are two dangers, one immediate, the other remote. The former is the possibility of an abscess which may rupture into the rectum, perineum or peritoneum. When the abscess drains into the urethra the result is considered favorable, but if it ruptures into the peritoneum, a fatal peritonitis may result. The remote danger is that the resolution may not be complete and that a focus of infection may persist. We have found that, as a rule, a permanent cure is easier to attain with the severe prostatitis, or when there is an abscess, than with the insidious chronic form.

The time required to allay the symptoms varies from one to three weeks, but the induration may require from three to six or twelve months in which to subside, if the disease passes through a chronic stage.

ABSCESS OF THE PROSTATE.—Abscesses are of two varieties, the first beginning in the gland-crypt, with its duct occluded. These are more frequent and less serious than the second form, which begins at a point of intense inflammation or necrosis in the stroma of the gland. Either may be multiple, and by coalescing may increase in size and involve a considerable proportion of the prostatic substance. In rare cases the entire gland is converted into a suppurating cavity. The symptoms are the same as in the severe acute prostatitis, the constitutional symptoms gradually becoming more marked, and the pain and throbbing more intense. The follicular abscesses may be much milder; in fact, we have seen one patient with no pain or inconvenience except moderately frequent urination, who was even unaware that his prostate was involved until it ruptured into the urethra. The pressure on the urethra when the abscess points toward it may cause retention of urine. Fistulous tracts may be left if the abscess ruptures into the rectum; or after much tissue has been destroyed, when the abscess has broken through the perineum.

PROGNOSIS.—Prostatic or peri-prostatic abscesses are very painful and may be dangerous to life.

PERI-PROSTATITIS.—The inflammation may extend into the tissue around the prostate or into the deep perineal space, the anterior perineal wall being so infiltrated and hard that the organs cannot be outlined. This may suppurate and form a peri-prostatic abscess. Fluctuation may be detected in the perineum or in the anterior rectal wall. A very rare and dangerous com-



plication is phlebitis of the peri-prostatic plexus. There are severe constitutional symptoms, and the hard irregular tumor in the rectum resembles a "mass of thick cords."

TREATMENT OF ACUTE PROSTATITIS AND PERI-PROSTATIC ABSCESSSES.—Rest in bed with the hips elevated on pillows, cessation of all local treatment for gonorrhoea, light but nutritious diet; purgatives to produce daily two or three good evacuations from the bowels; hot sitz baths, repeated several times daily when the symptoms are severe; opium suppositories, hot applications to the perineum and bacterins comprise the main measures to be adopted in the treatment. Enemas or rectal irrigations, with hot physiologic salt solution, given once or twice daily, are often of value in allaying the pain and in promoting resolution. If retention of urine occurs, a soft rubber catheter, 14 or 15 French, should be introduced. The patient should drink freely of plain water, lithia water, lemonade, etc., and should take some such prescription as the following:

R	Tr. aconite -----	2.	℥ss
	Potassium citrate -----	15.	℥ss
	Sweet spirits of nitre -----	60.	℥ii
	Tr. hyoscyamus -----	4.	℥i
	Syrup of orange peel -----	15.	℥ss
	Water -----	qs. ad 180.	℥vi

M. Sig: ℥ii, four times daily.

Urotropin in ten-grain doses should be given four times daily to prevent cystitis. Suppositories of extract of opium ½ gr., extract of belladonna ¼ gr. and monobromate of camphor gr. v, may be introduced into the rectum twice daily, and the amount of opium increased if the pain is severe. There are milder conditions where the patient refuses to go to bed in which urethral irrigations of potassium permanganate, 1-5000, will be beneficial. These irrigations are of value to pa-

tients convalescing from more severe attacks and may be alternated with irrigations of 1-8000 to 1-5000 nitrate of silver. Careful watch should be kept for an abscess, and an occasional examination made in order to detect it before too much tissue has been destroyed, and before it has ruptured. When fluctuation can be detected, the patient should be prepared for the operation, anesthetized and placed in the lithotomy position, with a sound in the urethra, an incision should be made in the perineum and the abscess cavity well opened, the surgeon's finger being kept in the rectum to avoid cutting into the bowel. After making a free opening into the abscess it should be irrigated with hot physiologic salt solution, and packed with iodoform gauze, and the perineum covered with plain gauze and absorbent cotton. The dressing should be changed daily, until the incision has healed.

SUMMARY.—The prostate gland is of great importance in genito-urinary affections, being a favorable nidus for lingering infection. Its examination should be made even if there be only slight evidence, or even none, to suggest its involvement. Acute prostatitis develops as an extension or urethral infection, assisted perhaps by sexual or alcoholic excesses, physical exercise, instrumentation, etc. In acute prostatitis the gland becomes enlarged, hard and sensitive. The symptoms vary from slight increase in the frequency of urination with a little pain at the end of the act, to intense pain with great frequency and urgency. Considerable straining may be necessary to void the urine; at times complete retention supervenes. There may be terminal hematuria. Urethral discharge often ceases during the acute attack to reappear later. An increased frequency of urination, with or without pain in the perineum, should always suggest the possibility of prostatitis. A rectal examination confirms the suspicion. The prognosis as to the time necessary to effect a cure is better in acute prostatitis than in the chronic form.

Follicular or parenchymatous abscesses may develop, the former being much milder than the latter. The symptoms of acute prostatitis become intensified, the constitutional symptoms more marked and the pain and throbbing more severe. Examination may reveal soft foci of suppuration. Both prostatitis and prostatic abscess require about the same treatment, namely: rest in bed, diluent drinks, urotropin, light but nutritious diet, cessation of local treatment for gonorrhoea, evacuation of the bowels twice daily, hot sitz baths, hot applications to the perineum, opium suppositories, gonococcic vaccine, and phylacogens. Later urethro-bladder irrigations are instituted. Prostatic massage is never indicated in acute prostatitis. If an abscess forms it should be opened through a perineal incision.

## CHAPTER XII

## SUBACUTE AND CHRONIC PROSTATITIS

PATHOLOGY, ETIOLOGY, SYMPTOMS, DIAGNOSIS, PROSTATIC SECRETION, URINE AFTER MASSAGE, PERIODIC ACTIVITY OF THE PROSTATE, EFFECTS OF SEXUAL INTERCOURSE, DIFFERENTIAL DIAGNOSIS, PROGNOSIS, TREATMENT, PROSTATIC MASSAGE, AND SUMMARY

Generally speaking the prostate gland is the most frequent cause of recurrent or chronic urethral discharges and many more or less obscure urinary and sexual symptoms. An examination of the prostate is necessary, therefore, as a routine practice before an attempt is made to treat these disorders. As a source of reinfections the prostate and seminal vesicles are of great importance, for they are found to be the seat of gonococci vastly more frequently than all the urethral crypts and follicles combined. They offer an exceedingly interesting field for work on account of the diagnostic accuracy attainable and the success which, as a rule, follows the institution of appropriate treatment. In the majority of individuals with chronic prostatitis and vesiculitis the onset is insidious and there may be no symptoms to cause the patient to suspect that these organs are involved. In our own practice we have found the symptoms of very little value, except in especially well marked cases, and, therefore, the history should never be allowed to replace careful palpation and an examination of the secretion expressed or the urine passed after massage. Subacute prostatitis is not of frequent occurrence, and is characterized by much greater enlargement and by more pus in the secretion than the chronic form, and by milder symptoms than acute prostatitis.

**PATHOLOGY.**—In subacute prostatitis the gland is always enlarged and hard. This may be the case in chronic prostatitis. The hardness and swelling may be limited to one-half of the

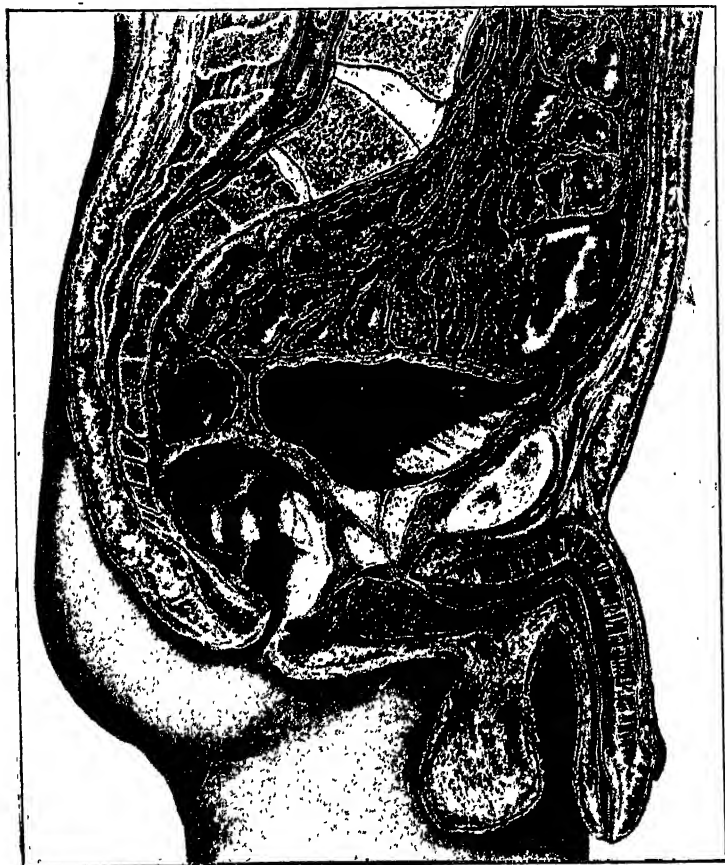


Figure 32.—Median Sagittal Section of the Lower Abdomen and Pelvis, Showing the General Relations of the Prostate to the Bladder, the Urethra, and the Rectum. (Deaver.)

prostate, or to one or more follicles. Occasionally, in chronic prostatitis, the gland is found smaller than normal, or, after an abscess, it may be irregular in shape. It becomes softer and of a "boggy" consistency at times.

The mildest form is merely an extension of a posterior urethritis, which involves the prostatic ducts. Where the changes are very slight they may involve only their mucous lining, and



Figure 33—Urethra and Bladder Laid Open from Above, Showing in the Bulbous Urethra the Orifices of the Ducts of Cowper's Glands, and in the Prostatic Urethra the Orifice of the Uterus Masculinus, with the Opening of the Prostatic Ducts on Each Side of the Verumontanum. Note the Orifices of the Ejaculatory Ducts on the Margins of the Orifice of the Uterus Masculinus. (Deaver.)

the pathological condition thus produced is of importance, chiefly because the infection in this manner may enter the sinus *pocularis*, or *acini*, and there produce an inflammation similar to that found in the urethra. The cells desquamate, serum and leukocytes exude into the cavity of the follicles and there is an infiltration of small, round cells into the perifollicular tissue. Some of the ducts of the follicles may become blocked and form small cysts. The secretion in chronic prostatitis contains pus, albumose, epithelial cells, micro-organisms, granular phosphates, amyloid and lecithin bodies, and other unimportant substances. The proteid in the secretion is digested by a ferment liberated by the disintegrating leukocytes called leukoprotease and albumose is formed. Eventually, as the condition progresses, the perifollicular round cell infiltration becomes organized, fibrous tissue resulting, which may or may not leave permanent nodules. Different parts of the gland will show different conditions according to these various stages.

There may be adhesions binding the prostate closely to adjacent parts, or, occasionally, thickening of the rectal mucosa over the gland. The urine nearly always contains urethral threads and pus, because a chronic urethritis is generally kept up by the chronic prostatitis.

**ETIOLOGY.**—There are two factors of great importance in the causation of chronic prostatitis; infection and congestion. About 75% of the cases are caused by the gonococcus, the remainder by the colon bacillus, the tubercle bacillus and the ordinary pyogenic micro-organisms. The congestion previously induced by excessive masturbation favors the occurrence of prostatitis. During an urethritis alcoholic and venereal excesses, neglect in the treatment, prolonged ungratified sexual desire, muscular exertions, and the passage of urethral instruments are likely to cause the germs to pass back into the deep urethra, and

from there they may invade one or more of the prostatic ducts and start a lowgrade inflammation. This may remain quiescent until subsequent circumstances stimulate the germs to greater activity, with the result that they gradually become more deeply seated, and other follicles become involved. Chronic prostatitis may follow as a sequel of acute prostatitis.

Hemorrhoids, or rather the congestion that produces them, increase the likelihood of chronic prostatitis, as does frequent withdrawal during coitus before orgasm has been reached; such practices leave the parts congested each time.

Other etiological factors are calculus in the prostate or bladder, exposure to cold, mechanical injury, horseback and

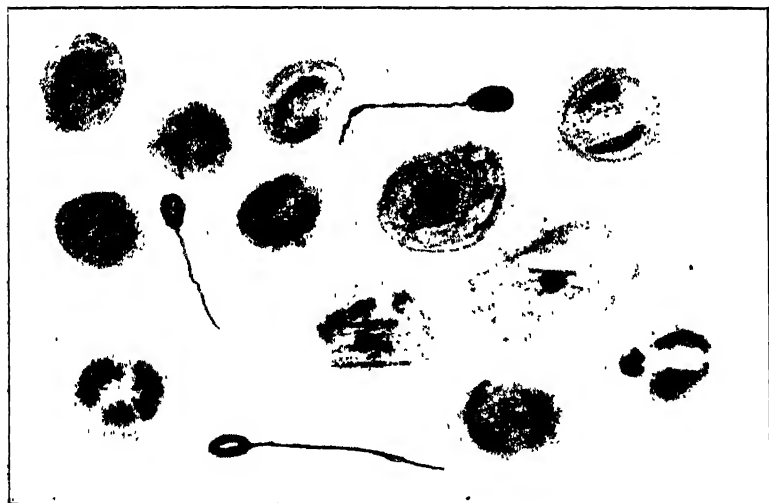


Figure 34.—Secretion from Inflated Prostate: Pus Cells and Epithelial Cells Showing Partial Digestion—no Well Defined Outlines.

bicycle riding, (before gonorrhoeal urethritis has been cured urethral stricture, cystitis, and hypertrophy of the prostate.

**SYMPTOMS AND DIAGNOSIS.**—Where a persistent or recurrent urethritis exists the prostate should always be regarded as the chief focus of the infection until it is found to be other-



wise. Any symptoms referred to the urinary or sexual functions should suggest the necessity of examining the prostate and its secretion. Sexual weakness is frequently seen in these patients; erections may be weak or absent, and ejaculations may be premature or painful, nocturnal emissions are frequent and the discharged semen may be stained with blood. This is more likely if the vesicles are inflamed.

Frequency of urination is found in severe cases, pain usually occurring during the act or at the end of micturition. Urgency in the desire to void urine depends on the degree of posterior urethritis, and is always present to some extent. Occasionally there are symptoms of urinary obstruction, due to the inflamed prostate, which may be relieved entirely by treatment of the prostatitis. Referred pain may be found anywhere between the umbilicus and the knee, the most frequent place being in the sacral region of the back.

A decided feeling of mental depression occasionally follows prostatic massage which lasts for several hours; in other patients just the reverse may occur, and they have a feeling of wellbeing. Neurasthenia and melancholic symptoms are sometimes produced by chronic prostatitis.

THE PROSTATIC SECRETION expressed by massage may appear at the meatus, or may remain in the urethra and be washed out by the urine. It is on two substances found in the secretion that we rely for an accurate diagnosis; they are pus and proteid.

If the urethra has been flushed previously with clear urine or irrigated with a physiologic salt solution, and the drop of discharge obtained from the meatus after massage shows pus cells, then we know the prostate is inflamed. Should the number of pus cells be small the smear must be stained with methylene blue or azure and eosin, after fixing with heat. The presence of polymorphonuclear cells proves the existence of

prostatitis if the urethra as a source of contamination has been eliminated. There are large and small cells resembling the mononuclear lymphocytes which are found in the normal prostate in small numbers and, consequently, in a doubtful case the secretion should be stained. The pus and epithelial cells are partially digested and do not stain clearly.

The demonstration of gonococci in the prostatic secretion, after a thorough urethral irrigation, is not as easy as one might expect from the history of the recurrences in these patients.

Dead spermatozoa are frequently, but not always, found in the secretion expressed. This, we think, in many of the patients, is due to a lowgrade seminal vesiculitis.

URINE AFTER MASSAGE.—When the secretion does not appear at the meatus, and the urine before massage is free from pus and that after massage contains it, we have conclusive evidence that the prostate is inflamed. The vesicles should be left untouched if a differential diagnosis between vesiculitis and prostatitis is being made. If there is pus in the urine, the urethra and bladder should be irrigated with a physiologic salt or boric acid solution, a small quantity of which may be left in the bladder to be passed after massage.

Another substance equally characteristic of prostatitis is the presence of proteid in the urine or fluid passed after massage. This can be demonstrated easily by making a layer test with the urine superimposed on a saturated solution of magnesium sulphate (9 parts) and nitric acid (1 part). (Roberts.) This reagent shows the presence of any proteid substance by a white ring at the plane of contact with the urine. The urine before massage should always be tested to find if it is free from albumin, and if it is not, the urine should be voided and the bladder filled with a physiologic salt solution. If the inflammation is slight, only a small amount of urine or fluid should be retained,

as the proteid may not be detected if greatly diluted. The kind of proteid present naturally varies according to the character of the inflammation. An abscess draining into the urethra gives a large quantity of serum albumin; this also is found, but less abundantly, along with albumose and nucleo-albumin in acute prostatitis. In the subacute and chronic inflammations albumose is constantly found alone or combined with nucleo-albumin. The urine must be tested for albumose soon after being passed. This is necessary, because, after it has stood several hours, certain changes take place which prevent as distinct a reaction as is obtained earlier. A precipitate is formed, which settles to the bottom of the glass, and the urine above shows a less marked reaction than at first. This does not always occur, nor are we able to explain the nature of the process.

The heat and acetic acid test will not show up the albumose, because it is soluble when heated to the boiling point and does not even give the cloudiness at about 60 degrees C. (140 degrees F.) as does the Bence-Jones albumose. Nitric or citric and picric acids, if added to the urine, will cause the albumose to be precipitated. The albumose disappears when heated. If serum-albumin and nucleo-albumin be present they may be differentiated from albumose by the following method: After bringing the urine to the boiling point and adding the acid the serum-albumin and nucleo-albumin may be deposited in the bottom of the test tube by placing the test tube in a hot water bath. This will keep the albumose in solution while the serum-albumin and nucleo-albumin are being precipitated. If the tube now be allowed to cool, the albumose will settle on the albumin with a very distinct line of demarcation between them, and a difference in the quality of the two layers of the precipitate, can be detected.

In chronic prostatitis considerable debris, composed of pus, mucous, phosphates, epithelial cells, spermatozoa, etc., will be

present in the urine voided immediately after massage. The presence of pus enables one to make a diagnosis by a microscopic examination. Cloudiness in the urine voided after massage of the prostate that persists after the addition of acetic acid nearly always indicates an inflammation of the prostate. Large casts of the dilated follicles may also be observed. These same patients, however, on other occasions may fail to show much macroscopic debris or casts, but will have the amount of proteids considerably increased.

Where there is a large quantity of albumose with very few pus cells in the secretion, the condition is called sub-chronic prostatitis.

PERIODIC ACTIVITY OF THE PROSTATE.—We have previously directed attention to the periodic increase in the prostatic secretion, without any apparent cause, which occurs every two to six weeks. Further experience has enabled us to confirm this observation in many other patients. The increase varies from two to five times the amount obtained after massage during the intervals, and is sometimes attended with an aggravation of the urethral symptoms. This seems to be analogous to menstruation in women.

Additional facts bearing on this subject have been found in Deaver's excellent monograph on "Enlargement of the Prostate." John Hunter is quoted as having studied the prostate gland of moles, and found that, while it was small and insignificant during the winter—the period of quiescence—in the rutting season it becomes larger and filled with mucus. These observations were confirmed by Owen and Griffith. The last named author also found the same changes in the prostate of hedgehogs. The above mentioned analogy seems borne out by these facts, regardless of whether the prostate and uterus are analogous or not.

**EFFECT OF SEXUAL INTERCOURSE.**—It is thought by some observers that the secretion and debris of the prostate are cleared out of the inflamed ducts and follicles by sexual intercourse, but this is not always the case. The watery portion of the secretion probably escapes as part of the ejaculated fluid, but the masses of mucus, phosphates, etc., may be expressed by massage within a few hours after intercourse, showing that the so-called “active or physiologic massage” is not always to be relied on to clear out the follicles. The seminal vesicles and ampullations of the vas deferens are emptied to a much greater extent than is the inflamed prostate.

The so-called neurosis of the prostate, which is seen after all of the inflammatory symptoms subside, in reality will be found to be caused by a growth of attenuated organisms in the prostate gland. It is a subchronic inflammation, the germs having lost their virulence continue to produce a more or less irritating and annoying toxin, however, pus is not present in the secretion. One will be misled in the diagnosis if reliance is placed on fixed and stained smears. To see and appreciate these organisms they must be viewed by dark field illumination, or stained alive with an aqueous dahlia solution as described under the head of the etiology of prostatic hypertrophy.

**DIFFERENTIAL DIAGNOSIS.**—Hypertrophy of the prostate may be diagnosed by rectal palpation, the history of urination gradually becoming more frequent and difficult after the age of 50, increased frequency of micturition at night, elongation of the urethra, residual urine, etc. Acute prostatitis, and much less frequently, chronic prostatitis, may cause urinary obstruction. An hypertrophied gland may become inflamed and give all the symptoms of prostatitis intensified by the urinary obstruction. There is a well-marked difference between these conditions which should always be considered in the diagnosis and treatment. The history, a careful rectal and perhaps ure-

thral examination, a microscopic study of the secretion and a chemical examination of the urine (passed after massage of the prostate) will enable one to decide, as a rule, which is primary; the hypertrophy or the inflammation.

Tubercular prostatitis is rare but sufficiently like that of gonorrhoeal origin to make a diagnosis difficult in certain instances. In tuberculosis there may be evidence of the disease in other organs, as the lungs, joints, bones, kidneys and especially in the testicle. Tubercle bacilli in the secretion would, of course, be conclusive, but they would probably not be found. Injection of the fluid into the peritoneal cavity of the guinea-pig would be more likely to clear up the case. The tuberculous prostate is usually larger, more nearly round and harder than that affected by an ordinary chronic inflammation. There may be a history of gonorrhoea or secondary infection to add further to the confusion.

Carcinoma of the Prostate has two characteristic symptoms, severe pain independent of urination and a stone-like hardness. There may be marked irregularities on the rectal surface, and the rectal mucous membrane may be adherent. As the disease progresses there is infiltration of the surrounding tissue. Abundant and widely disseminated bone metastases may occur. Casper thinks the pains are evoked through compression to the nerve trunks by the tumor and its metastatic swellings. Patients with prostatic cancers steadily grow worse. They may, perhaps, be saved by an early diagnosis and a radical operation.

Syphilitic Enlargement of the Prostate is rare, but should be considered when no other cause can be determined. Especially should anti-luetic treatment be given if other measures fail and there is a history of syphilitic infection.

PROGNOSIS.—The prognosis in chronic prostatitis may be considered good so far as the patient's general health is con-

cerned, but to cure the infection entirely, requires prolonged and careful treatment. The urethral discharge dependent upon it will cease, the urethral threads clear up, the sexual function improves and the patient feels normal in every way; yet still there may be present mucus, bacteria and granular phosphates, with perhaps a few pus cells and albumose, which apparently do little immediate harm. To bring about this result, treatment must be continued from 4 to 12 months and all associated complications must receive proper attention. As a rule gonococci do not remain in the prostate after two or three years unless there have been reinfections or severe recrudescences. No patient should be given permission to marry, however, before a careful examination for the purpose of deciding the question of their absence has been made.

We know of no method of treatment that will eradicate attenuated organisms from the prostate when once established.

**TREATMENT.**—The location of the prostate necessarily makes its treatment unsatisfactory and tedious, but the results always more than justify the time and care thus expended.

The diet and hygiene are much the same as are indicated in chronic urethritis, with perhaps a little more liberty in sexual indulgence, after all infection and recurrent urethral discharges have disappeared. Hot sitz baths, followed by a cold bath or cold sponging, moderate exercise, tonics now and then and regulation of the bowels are of value, but, like the other treatment, they should be used with due regard for the needs of each patient.

**PROSTATIC MASSAGE.**—In the treatment we rely chiefly upon massage of the prostate, and to Eugene Fuller is due the credit of directing attention to this method of treatment. It empties the distended follicles and removes an irritating secretion which has very little, if any, opsonic power. The circula-

tion is improved and the small round cell infiltration gradually disappears. The nutrition and general tone of the gland seem to be favorably affected, and the prostatic symptoms are often promptly relieved. In massaging the prostate, the position preferred by the writers is the "dorsal," with the knees drawn up similar to the posture assumed by women for vaginal examination. This is more comfortable for the patient than the knee chest position which is sometimes used. It is less embarrassing than the stooping posture, and affords satisfactory access to the prostate. If the examiner's finger is very short, or if a thorough examination of the vesicles is to be made, the bladder should be filled, and counter pressure applied above the symphysis with the other hand.

Thin rubber gloves are much more satisfactory for regular work than finger cots. After the examination they may be washed and dried with a towel before being removed. With fastidious patients, it is well to provide a separate glove for each of them.

Enough urine should be voided before the treatment to wash out the urethra, so that when the remainder is passed after massage it will contain only the secretion from the prostate. The right side of the gland can be examined better with the right hand and the left with the left hand, but a single examination is usually sufficient. The forefinger of the glove should be lubricated with vaseline and gently introduced into the rectum, successive gentle strokes are then made from the side toward the median line and from above downward, gradually increasing the pressure. Special attention should be directed to the enlarged portions. The operator should never attempt, however, to massage until the nodules disappear, which is suggested by some writers, for frequently the lumps are due to the cellular infiltration, and there may be no appreciable change in size after massage. At other times, when the swelling is due largely to distention of the follicles, a lessening in the size may be perceptible.



After the sides of the glands have been massaged, a few firm strokes are made in the mid-line from above downward. This last pressure will frequently cause the expressed secretion to appear at the meatus if it has not already done so. To force this secretion through the urethra, however, it is not always possible. The amount varies from a few drops to a tablespoonful. Where the quantity is expected to be excessive, a pledget of cotton should be placed over the meatus before beginning the treatment, to protect the clothing.

The patient now urinates into one or two glasses. The test is then made for proteid and a specimen is examined under the microscope for pus for the purpose either of making a diagnosis or of observing progress. An irrigation with potassium permanganate, 1-6000 to 1-4000, or nitrate of silver, 1-8000 to 1-6000, is now given to wash out and medicate the bladder and urethra, or, if preferred, some of the other forms of urethral treatment as described under chronic urethritis may be used, as indicated. A massage should be given about every two or four days at the beginning, and the interval between treatments should be lengthened gradually; the swelling, pus, and debris diminish until toward the end only one massage a month is required. The time necessary to effect a cure varies with different patients. The danger of overtreatment exists here as in chronic urethritis.

Hot rectal enemas or irrigations with physiologic salt solution should be taken by the patient before retiring each night for about two weeks, and every other night for the same time, and then gradually discontinued. When irritation of the rectum is caused, they should be stopped earlier.

All that has been said about the treatment of chronic posterior urethritis must be remembered and applied when indicated. The same may be said of strictures, seminal vesiculitis, and all the complications, which should be treated simul-

In case acute exacerbations occur, we should resort to suppositories and other remedies mentioned under the treatment of acute prostatitis.

For application of the vaccine treatment see chapter on this subject.

**SUMMARY.**—Chronic prostatitis is very insidious and may be present when the patient suspects no deep seated involvement as a cause for his uncured urethral affection. Examination should be made as a routine in all urethral affections. The gland may feel enlarged, nodular, boggy, or it may feel smaller than normal. The important point in the diagnosis is to demonstrate the presence of pus cells in the secretion expressed from the prostate gland. Of course the urethra should be eliminated as a source of such contamination. An excess of proteid material (chiefly albumose) is also present in the urine voided after massage. (Study well the differential diagnosis of prostatic disorders). Two factors are of chief importance in the causation of chronic prostatitis, infection and congestion. The situation of the prostate makes the treatment more or less unsatisfactory, but the results always more than repay the patience and care thus expended. In the treatment of chronic prostatitis we rely chiefly upon massage of the prostate and soothing urethral irrigations. The patient should refrain from sexual and alcoholic indulgences. Vaccine therapy is of some value in the more active conditions, but has little influence over the very chronic affections. As there is almost always urethral inflammation, all that has been said about chronic urethritis should be used to supplement the remedies directed solely to the prostate.

## CHAPTER XIII

## PROSTATIC HYPERROPHY.

HISTORY OF THE BOTTINI METHOD AND THE PERINEAL AND SUPRAPUBIC OPERATIONS, ETIOLOGY, TECHNIC OF SECURING ORGANISMS FROM THE PROSTATE GLAND, MICROPATHOLOGY, CONCLUSIONS, SURGICAL ANATOMY, PATHOLOGY AND SUMMARY

HISTORY.—The prostate gland was discovered in the 16th century by Nicholaus Massa, and in the next century it was found by Riolanus to cause obstruction to the passage of urine. The ancients considered hypertrophy of the prostate to be an "excrecence" of the neck of the bladder, and the first attempts at relief were, naturally, through the penile urethra.

THE BOTTINI METHOD.—The pioneers in prostatic surgery were LeRoy d'Etiolles and Guthrie, 1832 to 1836, the former advocated incision and scarification of the prostate through the urethra, while the latter established the procedure of "snaring" the projecting middle lobe. Mercier, in 1837, devised a special instrument to be used not unlike our urethrotomes of today. LeRoy d'Etiolles and Civiale claimed priority. Mercier revived this method in 1856 by devising an instrument, the prototype of Bottini's, which later was introduced in 1873 and improved in 1877. Bottini's galvanocautery instrument gained little headway until 1897, when modified by Freudenberg. Then it became popular in France and to some extent in America, where it had a few enthusiastic advocates. It never gained much of a foothold in England. Hugh Young (1902) suggested blades of different sizes, and Tenney, in 1904, presented an instrument with endoscopic attachment which enabled the operator to see the application of the cautery.

**PERINEAL OPERATIONS.**—The various methods devised for incising, tunneling or removing the obstructing portion of the prostate through the perineal urethra came into favor earlier than the suprapubic route, for in removing stones polypoid growths were occasionally accidentally excised. Guthrie, 1831, was the first to establish a regular procedure of incising “the bar at the neck of the bladder.” In 1874, Gouley began to use Mercier’s glavanocautery through the perineum. Later, Harrison advised tunneling the obstruction by the same instrument, but long ago, John Hunter, Brodie, and Home had tried tunneling with a sharp instrument, but on account of its danger, this method was abandoned. Others devised special gavanocautery instruments to be used through the perineal route. (Watson, Wishard, Norton, Chetwood.)

Billroth, in 1867, was the first to do a total prostatectomy, but it was for cancer. Gouley (1873) first outlined and executed a plan for a complete removal of the enlarged prostate. Harrison advocated removal of obstructing masses. Leisrink, in 1882, did a total extirpation through the crescentic perineal incision of Celsus and Zuckerkandl. This was for malignant disease, and the divided ends of the urethra were sutured. Dittel (1890) proposed a different approach, making the incision from the coccyx forward, around the rectum and through the middle of the perineum. He removed a wedge-shaped portion from the sides of the gland. Goodfellow (1890) began systematic removal of the prostate through a median perineal urethrotomy incision, and in 1895 Norris incised the capsule of the gland in the midline but did not open the urethra. Parker, Symms, Lydston, Delbet, DePezzer and Young, introduced tractors and instruments. In 1901, Albarran, advocated a median perineal incision in the urethra, into which the finger was passed to pull down the prostate. Murphy (1902) introduced hook retractors for depressing the gland. Instead of the instruments for holding the prostate steady and depressing it.

such as were later devised, Nicoll (1894) used a suprapubic cystotomy incision in order to press the gland down, but he did not open the urethra. Bryson, in 1899, advised a similar incision down to the bladder, but not into it.

**SUPRAPUBIC ROUTE.**—In 1827, Ammusat removed the middle lobe with scissors through this route (Deaver). Bellfield, in 1886, also did the same operation, but McGill, of Leeds, was a more ardent advocate of this method, which he adopted in 1887. Fuller was among the pioneers in suprapubic prostatectomy and suggested counter pressure on the perineum, and an incision into the urethra for better drainage. He claims priority, and apparently justly, for the operation now claimed by Freyer. In 1889, Guiteras suggested the method of PierreFranco (1870) of lifting up the gland with two fingers in the rectum and the thumb on the perineum.

Indirect operations have been castration, advocated by White (1893); ligation of the vasa differentia (1894), Mears; vasectomy (1893), Harrison; angioneurectomy (1895), Albaran; ligation of the internal illiac artery (1895), Bier; and prostatopexy (1902), Delagerniere. All of these methods have been shown to be futile or dangerous and uncertain. Watson divided prostatic surgery into two periods. Before 1890, characterized by the early development, and after that date, the active period. Formerly much opposition was advanced against removal of the prostate, notably by Thompson of England, Guyon of France, and Socin of Italy.

**ETIOLOGY.**—Prostatic hypertrophy is comparatively infrequent in the negro, Chinese and Japanese. It is rare that much inconvenience is caused before fifty years of age, but reasoning from the subsequent growth it would appear probable that enlargement had been gradually proceeding for a considerable

period before that time. It very infrequently makes its first appearance later than the seventieth year.

As the etiology is still in doubt and may require many years and much study to prove or disprove certain theories, considerable space will be devoted to what to the writers seems a likely cause. The subject needs more study and careful correlation of observations. The observations should be made early in the enlargement before the secondary changes due to obstruction have developed. As no theory formerly advanced has satisfied all of the demands they will not be discussed. In 1896, Ciechanowsky advanced the view that hypertrophy was an effect of gonorrhoea. While his views have been verified by some observers, many others have seen patients with hypertrophied glands who had never had gonorrhoea.

We have previously advanced the theory that prostatic hypertrophy was caused by the growth in the gland of attenuated organisms, which when continued for years caused an overgrowth by the prolonged toxic irritation produced. Adami says toxic irritation small in amount and long continued may cause overgrowth of the tissues subject to such irritant. By careful examination of the secretion of the prostate we have found in 350 patients that myriads of colon bacilli, staphylococci, and other organisms may grow in the prostate without inflammation or pus being present. This condition persists for many years. We cannot conceive of these germs growing in this manner without producing toxins, even though the organisms have become so attenuated that a true inflammation is not produced. Since it is generally admitted that toxins long continued may produce a hypertrophy, and since prostate glands in all stages of hypertrophy show the low-grade germ growths, is it unreasonable to assume that perhaps these germs produce the toxin which causes the hypertrophy?

TECHNIC OF SECURING THE ORGANISMS FROM THE PROSTATE.—The question has occasionally been raised that it is not clearly shown that the organisms come from the prostate, but may be from the urethral canal or in the urine. This question can be quickly and positively settled by comparing the number of germs in the urine passed before massage, with the number present in the urine after massage of the prostate. The increase seen undoubtedly comes from the prostate if the seminal vesicles are not massaged, for urine of the same quality passes through the same channel before and after expressing the secretion.

Copious irrigations of the urethra and bladder before massage and the presence of millions of organisms in the prostatic secretion expressed through the washed urethra also prove that the germs must be from the prostate. These facts would not be so conclusive if culture methods were adopted in determining the presence of the germs instead of the dark field illuminator and by staining the germs alive and watching their active motility for days. An easy method of staining the organisms so as to retain their mortality is to add an equal quantity of a 1 per cent. aqueous solution of dahlia to the secretion, mix, transfer one drop to a clean slide, place over it a cover-glass and seal it in place with melted paraffin. It should now be placed on the stage of the microscope and allowed to remain still for several hours to allow all particles of debris and the precipitate which is formed if urine be in the secretion, to settle and leave only the organisms in motion. It is unusual to see many germs present when there is much pus in the secretion. The typical specimen is one in which little or no pus is present, and macroscopically it looks like milk diluted with water.

The clinical symptoms that attend these infections are: Hyperesthesia of the deep urethra, sexual neuroses, the symptoms present when there is hypertrophy of the verumontanum, occasional mild irritation of the bladder without the evidences of inflammation, premature emissions, frequent nocturnal emis-

sions, itching of the urethral canal, a sensation as if discharge were coming out through the penis, but upon examination of the meatus none is found, perhaps a "morning drop" of mucus and sometimes sealing of the meatus with mucus. One of the first things one wishes to know is how these organisms become implanted in the prostatic follicles. The study of bacteriuria and bacterial infections demonstrates how large the number of ways in which infections of the genito-urinary tract may occur. Congestion of the prostate undoubtedly favors its becoming infected and the perpetuation of the attenuated growth of germs. Among the most frequent cases of infection is gonorrhoeal and other inflammatory conditions of the urethra, bladder, and prostate. Masturbation and prolonged ungratified sexual desire favor the congestion which enables germs passing in the urine to become implanted and grow without there having been a preceding true inflammation. Instrumentation of any kind, of course, may carry infection to the deeper parts. In fact, there are so many ways in which germs may enter the prostate that we are unable to say which is the most frequent one. Personally we think urethral and prostatic inflammations, masturbation and prolonged ungratified sexual desire are the most common causes, though some patients deny any such history. It is thought by some writers that colon bacilli can penetrate the rectal mucosa and in some way enter the prostate gland when it is acutely inflamed. Of course, there are other causes of prostatic enlargement, such as true adenomata, fibromata, myomata, carcinomata, but these enlargements are admittedly much less frequently encountered than is the ordinary prostatic hypertrophy. The presence of these germs in the prostate even when it is enlarged does not prove that they cause the enlargement, nor do we think positive proof or disproof possible.

Collateral and circumstantial evidence seems in accord with the examinations and histories of more than 500 prostates we



have examined during the past few years. Keyes says: "Bacteriuria is usually perpetuated by a renal or prostatic lesion." It is with the latter that we have largely to deal as regards the prophylaxis of such infections, for their extermination, when once well established in the prostate, has been practically an impossibility. This being the case, we must attempt to prevent such infection, if possible, and try to develop measures that will be curative. See section on prophylaxis.

Greene and Brooks have made extensive studies of the micropathology of prostatic hypertrophy with a view to establishing the etiological factors. They reached the conclusion of Ciechanowski that the underlying cause was a true inflammation of the deep urethra and prostate gland. The facts observed by them coincide as well with the opinion that the prolonged growth of mild infection with attenuated colon bacilli and staphylococci cause the hypertrophy by the toxins they produce. Our theory is thus in accord with both the clinical facts and the micropathology. It also meets the demands of physiologic pathology which teaches us that a mild toxin continued for a long time can cause hypertrophy. Many patients have prostatic enlargement who have not had gonorrhoea, though as previously mentioned, we often find myriads of the mild organisms in individuals who have never had gonorrhoea. The following facts are quoted from their observations because they dovetail so well with our views and complete the details we have not worked out:

MICROPATHOLOGY.—"Almost from the first, hypertrophy of the prostate was classed as a true tumor formation, and nearly all the earlier observers discuss the condition with this as a primary assumption. It was, however, noticed that metastases not follow in the wake of these supposed tumors, as was case in a considerable percentage of true tumors of similar appearance. Finally, when the use of the microscope became

general and it was employed in the study of prostatic hypertrophy, it was seen that the structure of these tumor-like enlargements of the prostate was almost identical in its elements, as well as in its arrangement, with normal glandular structure. As a result of these studies the condition now came to be considered as really of the nature of a hyperplasia, and it was found possible to classify the prostatic hypertrophies, independent of their form, into those made chiefly of fibrous tissue, those made up largely of muscle tissue, those consisting of glandular elements, and finally those in which the admixture of these elementary structures was in the same proportion as in the normal gland. It was now generally conceded that the process was in truth more in the nature of a fibrous, adenomatous, or muscular hyperplasia, and that the condition was not truly neoplastic in origin. Notwithstanding this plain statement of fact, there still exist many text-books—and among them excellent works on pathology—that continue to treat of prostatic hypertrophy as a tumor formation, pointing out that the development of fibroid tumors in the analogous female organ, the uterus, is a similar nature. Although the majority of the leading text-books on pathology and genito-urinary surgery have discarded this older theory, very few writers attempt to explain the manner in which this hyperplasia is excited, and why, contrary to most other hyperplastic processes, it is reported almost exclusively in old age instead of in youth, where it might more reasonably be expected to occur."

"For the purpose of determining this question the writers undertook the careful study of fifty-eight cases of prostatic hypertrophy, and published the results in an article in the *Journal of the American Medical Association*, April 26, 1902."

"Briefly, it may be said that their conclusions have been in full accord with the results of the masterly studies made in Krakow by Ciechanowski. Very early in the work it becar

apparent that, as a matter of fact, there were but two types of the glandular tissue and one of the connective tissue. In none of these cases were the writers able to find more muscle tissue in the hypertrophied areas than had existed in the normal tissue of the area involved; in fact, in most cases atrophy of the smooth muscle was well in evidence, and many cases had proceeded on to actual replacement of muscles by exudate or by young connective tissue fibrils and cells. It was then found that there was a distinct difference between the true cases of myoma of the prostate gland and those of prostatic hypertrophy of old age."

"In the other variety of prostatic hypertrophy, which, moreover, is the form most frequently found involving the middle lobe, the tumor is characterized by being made up mostly of glandular tissue, supported by a more or less well-defined connective-tissue stroma. It is this particular form that, on account of its close resemblance to adenoma, has largely substantiated the tumor theory of the disease. Careful analysis of sections so cut and orientated as to unite with the glandular acini of the normal portions of the prostate soon convinced the writers that this type was also to be included as merely hyperplastic and not as truly neoplastic. In short, it was found that all varieties of prostatic hypertrophy may be included under one of these heads, although the conditions are frequently associated in the same gland."

"Briefly stated, then, the cause of prostatic hypertrophy must consist of factors chiefly operative during old age and that are capable of causing growth of both epithelial and connective-tissue elements of the gland, either singly or together, and entirely distinct from the formation of true neoplasms."

"..... This examination has shown, in every case of adenomatous prostatic hypertrophy, that the ducts are occluded or obstructed from the pressure of an inflammatory

exudate in the more acute cases, or by hyperplastic connective-tissue about the ducts in the more slowly developing cases. It is then clearly apparent that the occlusion of these ducts causes, by the retention of secretion, the cyst-like dilatations of the acini; and that the proliferation of the alveolar cells first keeps pace with the dilating saccule, and then, continuing, results in epithelial desquamation."

"From this description of the pathologic anatomy of prostatic hypertrophy it is clearly evident why we have the fibrous type of enlargement so frequently associated in the same gland with the adenomatous form; for if the interstitial hyperplasia originate, or be more marked in the peripheral part of the gland, the result is that the acini become compressed, atrophied, and replaced by connective-tissue growth, whereas if the process originate in, or be most marked in or about the ducts, occlusion of these passages follows and the gland saccules become converted into adenoma-like cysts. The writers' conclusions in this respect completely corroborate the anatomic findings of Ciechanowski and of other observers."

"Taking for granted that this view of pathologic anatomy of prostatic hypertrophy is correct, one can then place no other interpretation on the etiology of the condition than that it is most certainly inflammatory."

CONCLUSIONS.—If we substitute irritation for inflammation where used by these writers, then the entire report is in accord with our theory. That we have ample reason for making the substitution of irritation for inflammation seems proved by the fact that pus (which is always present in a true inflammation of mucous surfaces) is absent or is present in very small amounts in the type of mild infections we are discussing, though the organisms are abundant. We cannot conceive of them thus growing without the production of a toxin. This toxin is no doubt similar in many respects to that produced by

these organisms when more virulent and when they produce pus. The essential difference is that the toxin is so mild that little or no pus and perhaps no symptoms of consequence are produced in these attenuated infections. We, therefore, cannot say that the process is truly inflammatory. The action, however, of the toxins on the tissues for many years appears to produce results more or less similar to those caused by inflammation.

There are intermediate conditions that show the presence of pus cells in small numbers in which there is little if any other evidence of inflammation; the organisms are here much more numerous than is the case when the pus is more abundant, and ultimately most of them pass into the type without pus. Chronic inflammation may thus gradually pass into this form of infection. Here and there may be small inflammatory foci which are incidents rather than essential factors in the production of hypertrophy changes, as is shown by the fact that the hypertrophy is not infrequently seen when no pus whatever can be detected in the expressed secretion, which does contain enormous numbers of organisms.

ANATOMY.—Under this heading only a few points will be mentioned. Sir Henry Thompson demonstrated forty years ago that the prostate, until the fourth month of fetal life, consists of two separate lobes which later unite around the urethra, and that the so-called third lobe in reality is a projection from the lateral lobes into the bladder, or rarely from the commissure between them. Each of these is enveloped by a thin, strong, fibrous capsule, which constitutes the true capsule of the gland, and is intimately connected to its substance. The prostate gland is further incased in a sheath formed by the rectovesical fascia, in the layers of which are plexuses of veins. There are, however, bands of connection between the capsule and the sheath, but it is in this "plane of easy cleavage" that the enu-

cleating finger must remain in order to avoid hemorrhage. This sheath also prevents extravasation of urine into the surrounding tissue after the operation. Freyer compared it to an orange, the inner thin fibrous tissue covering the segments and intimately connected to the pulp corresponds to the true capsule, while the rind represents the outer sheath, which is left behind in enucleating the prostate gland.

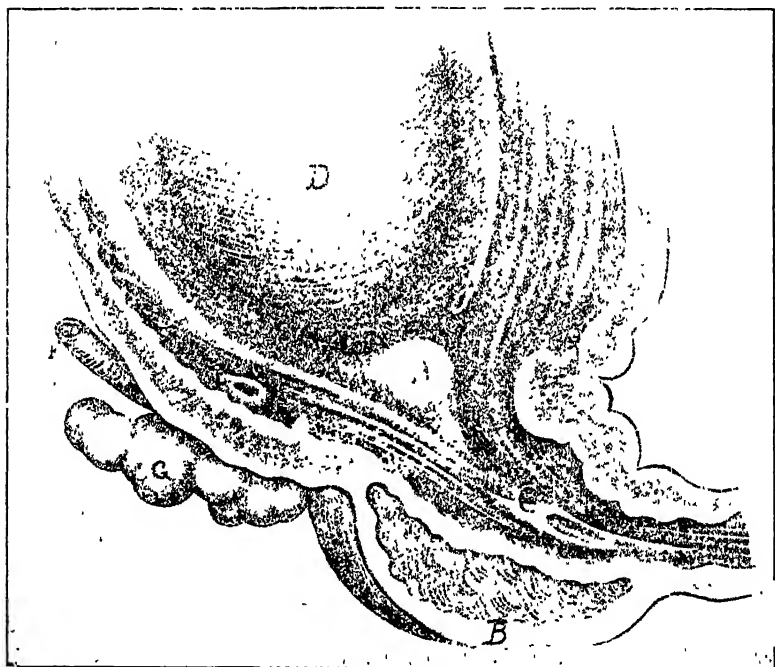


Figure 35.—Central Lobe Pathologic (Tumor-like.) A, Central Lobe; B, Lateral Lobe; C, Prostatic Urethra; D, Bladder; E, Ureters; F, Vas Deferens; G, Vesicula Seminales. (Ferguson.)

**PATHOLOGY.**—Walker, of London, classifies the glands into those which remain wholly within the sheath (this sheath covers the entire gland, except at its basal attachment to the bladder and at its extreme apex) and do not project into the bladder and those which project more or less through the v

sphincter. The majority take this latter route and have an extra-and an intravesical portion, separated by a groove produced by the sphincter vesicae. The glands assume an infinite variety of shapes; the obstruction may occur chiefly along the urethra, being due to the pressure of the lateral masses, or an obstructing mass may project into the urethra or into the bladder, or the enlargement may be back toward the rectum. Hypertrophy of the lateral masses often draws a fold of mucous membrane across the vesical opening of the urethra, forming the so-called "bar at the neck of the bladder." The prostatic urethra is lengthened, and may be dilated and contain a small amount of urine. The bladder wall loses its tone, becomes infected, cystitis develops, urine is retained, and ammoniacal decomposition follows. The urinary obstruction and back pressure may produce degenerative change in the kidneys. Later the ureters may become dilated and infected. The bladder either dilates and its wall becomes thin and pouched, or it may contract and the wall become thick and rugous. Enlargement, when once begun, nearly always produces residual urine, and often complete retention. (Lydston.)

SUMMARY.—The prostate gland was discovered in the 16th century by Nicholaus Massa. There are few organs of the body about which there has been so many divergent opinions as have been obtained in regard to the prostate gland, both as to its function, etiology of its hypertrophy, and management of the obstructive symptoms thus produced. It was the "Helen of Troy" about which many battles have waged. Before 1890 its surgical development was slow and unsatisfactory, much opposition being advanced by notable surgeons. After this date came the active period characterized by great reduction in the mortality, as well as by the gradual elimination of all methods except suprapubic and perineal prostatectomy.

The etiology of prostatic hypertrophy is still undetermined or at least not proved. We believe it to be due to a growth of attenuated organisms which produce a toxin that when continued for 20 to 30 years causes the hypertrophy. These organisms are found in a large number of individuals who have few if any symptoms of consequence and the germs continue indefinitely in spite of the treatment. Little or no pus is present, but myriads of actively motile organisms may be seen by the dark field illumination. The symptoms referable to them are usually those associated with a hypersensitive deep urethra and hypertrophy of the verumontanum. There are usually more or less sexual disturbances, chiefly hyperesthesia, with premature emissions; later, poor erections. As these organisms cannot be eradicated by any treatment yet proposed, prophylactic measures become of great importance.

In the enucleation of the prostate there is a plane of easy cleavage between the capsule and the sheath, in which the enucleating finger must remain in order to avoid hemorrhage and lessen the escape of urine and infection into the surrounding tissue.



## CHAPTER XIV

## PROSTATIC HYPERTROPHY

## Continued

SYMPTOMS OF PROSTATIC HYPERTROPHY, DIAGNOSIS, PROGNOSIS,  
TIME FOR OPERATION, CHOICE OF OPERATION,  
PALLIATIVE TREATMENT, RETEN-  
TION OF URINE,  
SUMMARY

**SYMPTOMS.**—Frequent urination at night is usually the first symptom and there is often difficulty in starting the urine and in expelling it; the stream has very little force and there is dribbling at the end of the act. The condition may continue without causing much inconvenience until some indiscretion sets up complete retention and the bladder becomes very much distended. There may be, later, frequent urination from the overflow of retention. A soft catheter should be introduced into the bladder, noting any obstruction. The distance from the meatus to the bladder is usually much lengthened. In cases of chronic retention, to withdraw all the urine at once may cause alarming symptoms, anuria or hemorrhage. The prostate should be examined through the rectum, to determine its shape, size, density, irregularities of any kind, and the condition of the bladder wall, if it is pouched and dilated, or thick and contracted. In passing the catheter into the bladder it should be remembered that the obstruction occurs in the posterior and the lateral walls of the urethra, therefore the catheter should be kept along the anterior wall. (Murphy). The amount of residual urine from one complete catheterization to another should be accurately measured.

**DIAGNOSIS.**—Prostatic hypertrophy may be confounded with atony of the bladder walls, cystitis, urethral stricture, vesical calculus, tuberculosis and carcinoma of the prostate. By bearing in mind the above symptoms and by a careful rectal examination, few errors need be made in the diagnosis. To distinguish carcinoma is the only real difficulty. The prostatic enlargements in which the adenomatous tissue predominates are quite prone to assume a cancerous nature. In fact, the more carefully specimens have been examined after removal, the more have been found to be malignant. Beginning changes cannot be recognized. Therefore, operative measures should not be unduly delayed. Hawley claims that cancer of the prostate demands close clinical observation, and that it is distinctly operable before metastases have taken place; the danger of delay in operating in doubtful cases is therefore evident. The symptoms are pain and tenderness; hard nodes in either a hypertrophied or a contracted prostate, with or without urinary obstructions. The rectal mucosa may be adherent to the prostate. Deposits may be found in the urethrovesical trigone, in the seminal vesicles, in the pelvic lymph glands, and diffuse metastases may occur in the trunk bones. The blood shows a myelocytosis. Every surgeon should be on the alert for the above symptoms, lest a grave mistake be made in the operation or prognosis.

**THE PROGNOSIS.**—The prognosis depends upon many things, as the age and the vitality of the patient, the duration and extent of the bladder and kidney involvement; the size of the prostate and the operation indicated. Out of 1000 prostatectomies performed by Freyer, stone in the bladder was found in 181 with a resultant mortality nearly twice as great as among those uncomplicated with stone. Which fact emphasizes the importance of early operations. Renal involvement is another grave danger that grows worse with delay.

Freyer gives the following statistics:

"In connection with these operations there were 55 deaths, or  $5\frac{1}{2}$  per cent., the remaining 945 operations, with the exception of one to which I will presently allude, being successful. With experience the mortality has been gradually diminishing from 10 per cent. in the first 100 cases to  $4\frac{1}{2}$  per cent. in the last 400; in my latest 100 cases there have been only 3 deaths. The causes of death were: Uremia due to chronic kidney disease, 24; heart disease, 8; shock, 7; exhaustion, 3; septicemia, 2; mania (hereditary in 1), 2; malignant disease of the liver, 2; bronchitis, 2; pneumonia, 1; heat-stroke, 1; pulmonary embolism, 1; cerebral hemorrhage with paralysis, 1; and acute pancreatitis, 1.

"Though all these deaths are accepted in connection with the operation, in not more than half the number can the fatal result be attributed thereto, the remaining deaths being due to disease incident to old age, and unconnected with the operation. This operation is comparable to none other in surgery owing to the advanced age to which it is mainly confined; and in judging of the mortality connected therewith, we must not lose sight of the fact that during the period of after-treatment and convalescence, men of this age are likely to be carried off suddenly by disease entirely unconnected with the operation, the occurrence, however, if accepted in connection with the operation, vitiating the results from a statistical point of view. Had the cases been selected, the mortality would have been infinitesimal; but as have been gathered from the successful cases described in detail in my numerous papers on the subject, selection would have condemned a large proportion of them to a painful death after prolonged suffering, instead of the complete restoration to health that ensued in each case after operation. It is, of course, impossible to avoid a certain small mortality when such cases are operated on. The wonder is that it is so small, con-

sidering the magnitude of the operation, the advanced age and conditions of the patients. But to refrain from operating in such cases, when there is any prospect of success, is to my mind utterly unjustifiable.

"Nearly one-half of the deaths connected with this operation were directly attributable to kidney disease resulting in uremia, and in a large proportion of the deaths set down to other causes the kidneys were also affected. Kidney disease incident to prostatic enlargements is, of course, due mainly to two factors—backward pressure, caused by the obstruction to the natural flow of urine, and ascending affection of these organs from the cystitis, which invariably results sooner or later from the habitual use of the catheter. I cannot, therefore, too strongly urge the enucleation of the prostate, when there is decided enlargement of that organ accompanied by urgent symptoms necessitating the employment of the catheter, before grave complications set in. When undertaken whilst the patient's general health is sound and the kidneys unaffected, there is practically no danger attaching to the operation in experienced hands; but when complications set in, and particularly when the kidneys become diseased, the operation must necessarily be attended by a considerable risk."

The question of sexual impotence after prostatectomy is one of interest. Sexual potency may or may not return after this operation. Freyer claims that no diminution of sexual capacity occurs after enucleation of the prostate by the suprapubic method he recommends. Young's technic preserves the ejaculatory ducts, by which it is hoped that the sexual function may be less affected. Freyer has been so impressed by the rejuvenescence of his patients after prostatectomy that he thinks perhaps the enlarged gland pours into the system some internal secretion of a toxic or deleterious nature.

As a rule, permanent control of the urinary function is restored by prostatectomy, the patient regaining his power of retaining his urine and voiding it naturally. Contraction at the seat of the operation, producing a stricture, is also unusual. Freyer says there were no instances of a permanent fistula in his 1000 prostatectomies.

TIME FOR OPERATION.—We have now reached the difficult problem. All surgeons agree that operative measures should be adopted before the “breakdown in catheter life.” Lydston says the earlier the operation the fewer are the obstacles encountered and that in the beginning enucleation of adenomatous growths may be done with ease, while if allowed to progress they may undergo changes which will make the operation very difficult. He thinks the operative mortality under favorable circumstances should not be higher than interval operations for appendicitis. Young has reported a series of 100 consecutive prostatectomies, without a death. Watson does not consider the use of the catheter advisable. If the patient has been using a catheter, and has such serious kidney and bladder complications as contra-indicate a radical operation, he advises suprapubic drainage with attention to the general health. If marked improvement follows, an operation is then indicated; otherwise, the surgeon should avoid a radical operation.

Cabot, of Boston, has shown that uremic symptoms disappeared after permanent drainage of the bladder and that pyelonephritis has been much improved or cured by such treatment. Deaver says there are many patients who only have to pass the catheter once or twice in 24 hours who may thus have life prolonged and sometimes live in comfort, but that their “expectancy” can be four or five years only, as shown by Harrison and Lydston. The consensus of opinion is that an early operation is the best. Catheterization may be used temporarily

until the patient's condition permits an operation of the next mildest method, permanent suprapubic drainage.

**THE CHOICE OF OPERATION.**—This is dependent upon circumstances, and no routine treatment for all cases can be advised. The anesthetic required for each case must be considered in deciding upon the operative procedure. Great importance is attached to the rapidity with which the operation is accomplished, thus lessening shock, hemorrhage and the danger of pneumonia. The suprapubic operation may be performed under nitrous oxide gas and oxygen. The mortality from shock, pulmonary complications, and uremia is about the same in

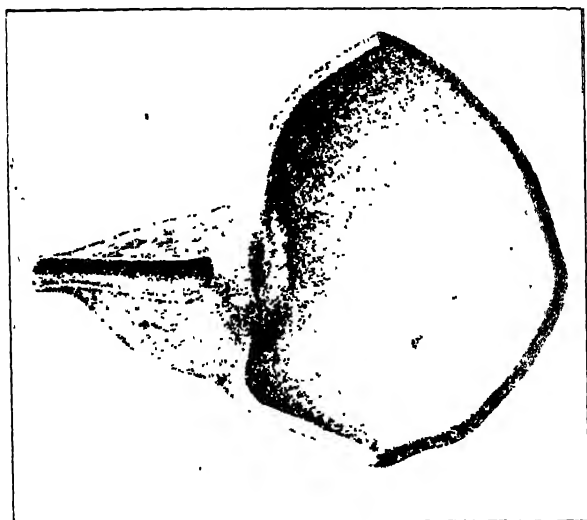


Figure 36.—Section showing contraction of neck of bladder; normal prostate. (Chetwood.)

both the suprapubic and perineal prostatectomy. Even with the apparently better drainage by the perineal method, statistics show that this route is attended with septic infection more frequently than the suprapubic.

The advantages of the perineal route are the low mortality and the fact that it is an operation open to visual dissection. The suprapubic operation carries less danger of injuring the rectum and membranous urethra, affords room for removing larger mass-



Figure 37.—Three lobes enlarged, obstructing the vesical orifice, bladder sacculated, contracted and containing calculi; A, median lobe; B, lateral lobes; C, prostatic urethra; D, bladder; E, calculi imbedded in pouches. (Guiteras.)

es, shortens the time required for the operation, gives better permanent results and enables the surgeon to easily remove calculi. The combined operation gives greater control of the gland and better drainage, but a mortality too high to make it worthy of favorable consideration.

No surgeon should have his method of procedure outlined before the examination of the patient. After this, all the facts elicited by the examination should be carefully considered and the operation selected which will probably be followed by the least number of complications. If the prostate has a large intravesical adenomatous growth, the suprapubic route is advisable. For fibrous prostates of small size and very adherent the perineal operation is better. A large number of cases intermediate between the small fibrous and the large adenomatous prostates, especially where the enlargement is along the urethra or projects into the rectum, the operation in which the surgeon has had the greatest experience will give the best results.

PROPHYLACTIC TREATMENT.—With the theory advanced in the foregoing pages as the probable cause of prostatic hypertrophy we would urge the consideration of all measures which lessen the infection of the prostate with attenuated organisms whether one subscribes to our views as to the etiology or not. Certainly, patients will be better without than with these infections which cause a hypersensitive deep urethra and hyperemia and hypertrophy of the verumontanum with their attendant sexual disturbances.

Since the majority of the infections follow gonorrhoea and other urethral inflammations, we should so treat these conditions as to lessen, if possible, the remote dangers. The staphylococcus and colon bacillus are the germs most constantly found in such prostates. Therefore, we treat all acute urethral inflammations with a mixed vaccine, hoping thus to immunize the patients during this critical period against the germs most likely to cause the long continued low-grade inflammation with final prostatic infection. Since, perhaps, patients may be immunized against typhoid fever, it does not seem unreasonable to hope that they might also be immunized against the col



bacillus—a germ closely related to the typhoid bacillus. Staphylococcal infections of the skin are benefited or cured by vaccines, so we might perhaps increase the patient's resistance to such organisms, at least until the critical period of urethral inflammation has passed. With this theory in view, we use mixed gonococcic vaccine in acute and chronic urethral inflammations, and while we are unable to express a positive opinion, it seems that the cures have been more complete and the patients have been annoyed less with persistent gleet<sup>y</sup> discharges than formerly. The utmost cleanliness must, of course, be exercised, so as to limit the number of germs carried into the urethra by the treatment. Congestion of the sexual organs, from whatever cause, should be studiously avoided—masturbation and prolonged ungratified sexual desire appear to be potent factors. Vaccines, whether autogenous or "stock," seem to be of no value late in the disease when the germs have become attenuated or the tissues tolerant. We have never seen beneficial results from vaccines when the process had passed the stage where pus was present. Consequently, we should persist with active measures until not only gonococci but all other complicating infections have been exterminated. The more chronic the condition, the slighter is the response to bacterial vaccines or to any other treatment. As a rule, it is an easy matter to destroy the gonococci compared to the difficulty of killing all the staphylococci and colon bacilli. An unfortunate thing is that often patients have already the low-grade infection before the acute gonorrhoea is contracted. Occasionally a very acute prostatitis will cure the chronic infection; more frequently a mild chronic infection will persist.

**PALLIATIVE TREATMENT.**—Patients with hypertrophied prostates should by all means lead a life regular in all details. Excess in diet, alcoholic beverages and sexual intercourse are especially harmful. The patient should studiously avoid cold,

damp weather and refrain from prolonged retention of the urine. There are patients who do well for years with little difficulty, if a well ordered life is strictly followed. Others with residual urine can be kept in good condition by judicious catheterization. So dangerous is infection of the bladder in these patients, that we should be most guarded in suggesting the use of catheters, and then only where there is some good reason why prostatectomy should not be performed. Then, after outlining the strictest asepsis, a number of suitable catheters should be selected and placed in glass tubes or a catheterostat, or some arrangement provided for their sterilization by formalin, boiling or prolonged immersion in antiseptic solutions. Probably one of the easiest ways of sterilizing the catheters is by having them placed in separate air-tight glass tubes containing a small quantity of formaldehyde. Each one should be numbered, and the catheters used in rotation. They should be washed thoroughly with soap and water after each operation before being placed in the tubes to be sterilized with the formaldehyde gas. A covered vessel containing a 2% solution of carbolic acid in water should be provided and the catheters placed in this solution for ten or fifteen minutes to remove the formaldehyde, which otherwise would cause considerable irritation. Small glass tubes can be obtained at a nominal cost and, with a cork in each end, furnish a very satisfactory method of sterilizing the catheters. Where this plan of sterilization cannot be adopted, the catheters may be boiled for a short time, but this soon makes their surface rough and the catheters are thereafter unfit for use. There are many devices upon the market for carrying catheters in small pocket size sterilizers which are also of value.

The patient should wash his hands and penis with soap and water, and then with 1-1000 bichloride of mercury or whiskey. The penis should be passed through a small hole in a sterile towel, and the catheter, after proper lubrication with sterile vaseline or olive oil and a small amount injected within the

meatus, is introduced without the hand touching any part of it except its distal extremity. In order that this may be done, the stiffer instruments are preferable to the very soft ones. A long applicator, passed two-thirds down the catheter, greatly facilitates the passage of the flexible instruments. It is needless to say that gentleness must always be observed, and if the instrument does not readily pass, patience is of equal importance.

This line of treatment should be discontinued immediately and more radical measures insisted upon, if the progress is not satisfactory, or if the patient's condition does not improve. Nothing is more unwise than to allow patients to become so enfeebled before advising an operation, that if it is performed at all, it is attended with great hazard to a successful result and to life.

Careless, ignorant patients should never be allowed to begin catheter life, as infection is almost inevitable and greatly handicaps the subsequent radical treatment.

**RETENTION OF URINE.**—Where the patient is unable to void any urine, the simpler measures and hot sitz baths, hot stupes, etc., should be tried first. In case they fail, a soft rubber catheter of medium size should be passed. If it cannot be introduced, the stiffer instruments should be resorted to, and finally a metal catheter may be tried, but with the utmost care. Filling the urethra with sterile oil or tragacanth lubricant and massaging it back toward the deep urethra will at times greatly facilitate the passage of a catheter.

Catheters with various curves may be tried until a suitable one is found. The "silk-web" ones are stiffer than those of soft rubber, while the semi-hard ones of English make are still less flexible, but they become soft when placed in hot water and may be molded into any shape which they retain when cool. Patience and practice are both necessary, but force is never required. In hypertrophy of the prostate it should be remembered

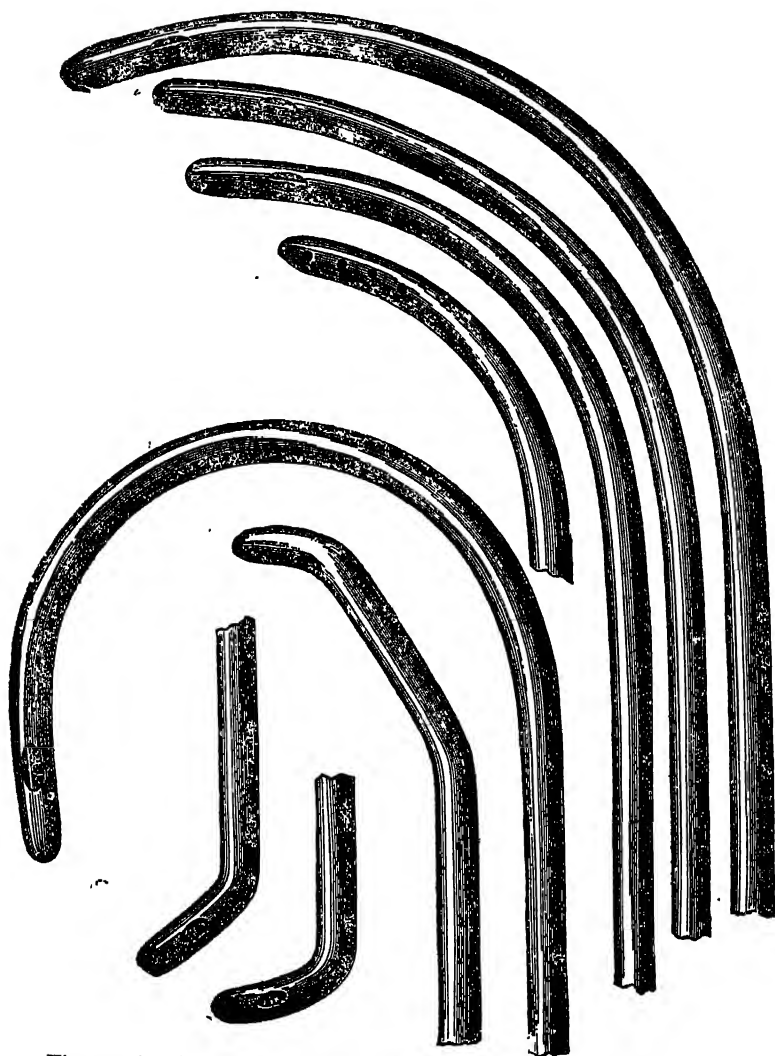


Figure 38.—Catheters of different curves used in hypertrophy of the prostate. (Casper.)

that the floor of the urethra is elevated and lengthened and that an instrument with a pronounced curve, as the bicoude, the Beneque or Guyon curve, will frequently be most readily introduced.

False passages are always dangerous, serious hemorrhage and septic infection being likely to occur. They will likewise increase the difficulty of subsequent catheterization. If after persistent effort a catheter has been introduced, it is probably safer to leave it in place than to run the risk of being unable to pass it subsequently. Deaver says that the permanent catheter, such as Pezzer's, should not be used where the urine is clear and uninfected, as it will almost always lead to the develop-

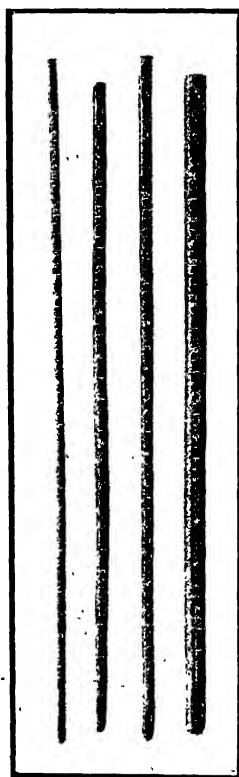


Figure 39.—Urethral catheters.

ment of cystitis. If the bladder is infected, no hesitancy need be felt as to its use; care should be taken, however, to cleanse the bladder once daily with irrigations of nitrate of silver 1-4000,

or with mercury oxycyanate 1-5000. These irrigations serve to keep the catheter from becoming incrustrated. Where indicated, Deaver uses this form of permanent drainage and converts the urethra into an artificial drainage canal. The urethritis produced, at first, soon subsides and the patient is allowed to get up.

In acute retention, where a catheter cannot be passed, the bladder should be punctured suprapubically with a small trocar. This may be repeated a number of times without danger. If the urethra is thus left undisturbed for a day or two, it will usually permit of catheterization. All of the urine should never be withdrawn at once, as profound shock, uremia, hemorrhage and perhaps death may be produced.

If the bladder is badly infected and the patient too weak for operation, suprapubic drainage is secured by the passage of a trocar and cannula; a catheter is then inserted through the cannula which is removed and the catheter is left in place for drainage and medication (see technic of this method under operative treatment.) Urethral drainage may be used instead, if preferred, by tying a catheter in place. By careful diet and hygiene the general health may be improved; the bladder and kidneys should be flushed with copious draughts of water and urinary antiseptics. If this does not bring about marked improvement, a radical operation will probably be disappointing. No two cases are just alike; therefore no routine measures can be advised, but the treatment must always be determined by the conditions to be combated.

SUMMARY.—The symptoms of prostatic hypertrophy are gradual increase in the frequency of urination, especially at night, and a gradual decrease in the size and force of the stream of urine. Rectal palpation enables one to determine the size of the prostate. A large prostate need not necessarily cause much difficulty in urinating, while a very small one

associated with a constricting fibrous "collar" at the neck of the bladder may give serious trouble. In recent years the improved technic has greatly reduced the mortality and at the same time has improved the functional results. Sexual potency may or may not be affected by prostatectomy. Permanent control of the urinary function is usually restored by this operation. The time for prostatectomy is when the patient's health is yet good and before the back pressure and infection have damaged the kidneys. The choice of the suprapubic or perineal route depends upon the preference and experience of the surgeon. Either method affords excellent results if the operation is properly performed. For large or medium size adenomatous prostates the suprapubic method is better; this also, as a rule, gives more uniformly good functional results. The perineal is better for the small fibrous prostates; there is greater danger of injuring the rectum and membranous urethra; the mortality is somewhat smaller than in the suprapubic operation.

The palliative treatment should consist of a life regular in all details; moderate in eating, drinking and sexual intercourse; avoiding cold, wet weather and prolonged retention of the urine. Never allow catheter life to be begun unless some very important reason renders prostatectomy inadvisable. The regular use of catheters is always dangerous, and if continued too long may greatly reduce the chances of a successful operation later, which is almost sure to be needed unless the patient succumbs to some other disease. The greatest care should be taken in the introduction of catheters and in the management of retention of urine.

## CHAPTER XV

OPERATIVE TREATMENT OF PROSTATIC  
HYPERTROPHY

PREPARATORY TREATMENT, TECHNIC OF SUPRAPUBIC PROSTATECTOMY, PERINEAL PROSTATECTOMY, TUBERCULOSIS OF THE PROSTATE, MALIGNANT GROWTHS OF THE PROSTATE, TREATMENT, AND SUMMARY.

In contemplating a prostatectomy we should never lose sight of the fact that the patients have a handicap in their age and of their infirmity; therefore, care should be taken in the preparation of the patient for this ordeal. The hazard would not be great if operations were done upon healthy men in the prime of life. Usually, though, the patient's kidneys are more or less impaired by disease incident to back pressure or age. For this reason tests to determine the renal functional capacity are very important and treatment should be instituted to improve the kidneys and to stimulate their activity both before and after the operation. It is much easier to prevent suppression of urine than it is to restore the function of the kidneys after this has occurred.

Knowledge as to the amount of urine passed in twenty-four hours, the amount of residual urine, the rapidity with which the quantity increases when an additional amount of water is consumed, the amount of albumin, and tube casts, and especially the rapidity with which pheno-sulphone-phthalein is excreted from the kidneys enable us to estimate their functional capacity sufficiently well to anticipate and thus minimize this greatest danger.

Satisfactory renal activity cannot, as a rule, be obtained without removal of the residual urine. This may be secured by



the use of the retention catheter placed in the urethra; or, as the writers often prefer, by the insertion of a trocar and cannula (after previous sterilization with iodine and cocainization at the suprapubic point) about  $\frac{1}{2}$  inch above the pubes. The cannula should be of sufficient caliber to admit a 12 F. catheter; if hemorrhage or a large amount of mucus is present, a larger catheter should be used.

The bladder should be well distended and the patient requested to tighten the abdominal muscles while the trocar is being inserted. A cystoscopic examination may be made through the cannula to determine the presence of stones and the character of the prostatic enlargement. Such an examination causes less discomfort than does an ordinary cystoscopic examination, and eliminates the possibility of retention of the urine being made worse after the examination, as a small catheter is inserted through the cannula, which is then removed and the catheter left in place for drainage of the bladder and irrigations (Belfield.) The catheter should be withdrawn until its distal end cannot pass into the deep urethra or a frequent desire to urinate will be produced. A suture passed through the skin at the site of the puncture and then through the catheter and tied, holds it in place. This simple and painless procedure is far preferable to a suprapubic incision, as ordinarily done in the two-way operation, for a number of good reasons: First, it can be done with less difficulty than the cystotomy and causes the patient less pain. Second, the amount of urine withdrawn can be accurately gauged and regulated so as not to drain off all at once if the distention is great. Third, the patient is not confined to his bed or his room by the operation and the clothing may be kept dry and clean. Fourth, ample drainage and means of medication are afforded by the catheter. Fifth, if the kidney function and the patient's health improve, prostatectomy may be done by either the suprapubic or the perineal

unsatisfactory, this temporary procedure affords drainage and comfort, and by removing the catheter occasionally and replacing it with a new one, he may continue for months with this method of drainage. Of course if the amount of residual urine is small and the kidney function good and no infection is present neither urethral or suprapubic drainage is necessary or advisable.

Affections of the lung should also be guarded against by selecting a time for the operation when the patient is free from colds and bronchitis; he should be allowed to wear his accustomed apparel when in bed, whether it be a red flannel undershirt and drawers or stiff bosomed white shirt. Changing from clothing the patient has ordinarily worn at night for years to a light cotton shirt that opens in the back and exposes his body much of the time undoubtedly favors pulmonary complications, which next to renal failure give us the greatest concern as to the patient's welfare. His position in bed should be changed frequently to prevent hypostatic pneumonia. A short anesthetic is of the utmost importance. Many times nitrous oxide gas and oxygen will afford satisfactory anesthesia, It may not give sufficient muscular relaxation without a small amount of ether. Everything possible should be done before the anesthetic is started so that no unnecessary delay is permitted on account of details which could easily have been arranged previously. A short anesthetic and previous preparation of the kidneys are of more importance than the route used or the actual enucleation of the gland, provided the method selected is the one best suited to the pathologic conditions present and the enucleation is done between the sheath and the capsule.

**SUPRAPUBIC PROSTATECTOMY.**—Generally speaking, this operation is preferable when there are stones in the bladder, or when the enlargement is chiefly intravesical, or if the median

portion is extensive hypertrophied, or if the gland is a very large adenomatous one.

The bladder should be well irrigated and distended with water or air, and the catheter left in place. In making the incision for the suprapubic operation, the important things to remember are to have the bladder well distended, to push up the fat and peritoneum with gauze so as not to enter the peritoneal cavity and to make the incision in the dome of the bladder rather than in the portion immediately posterior to the symphysis pubes, as healing progresses more satisfactorily when the bladder incision is so made (Squier).

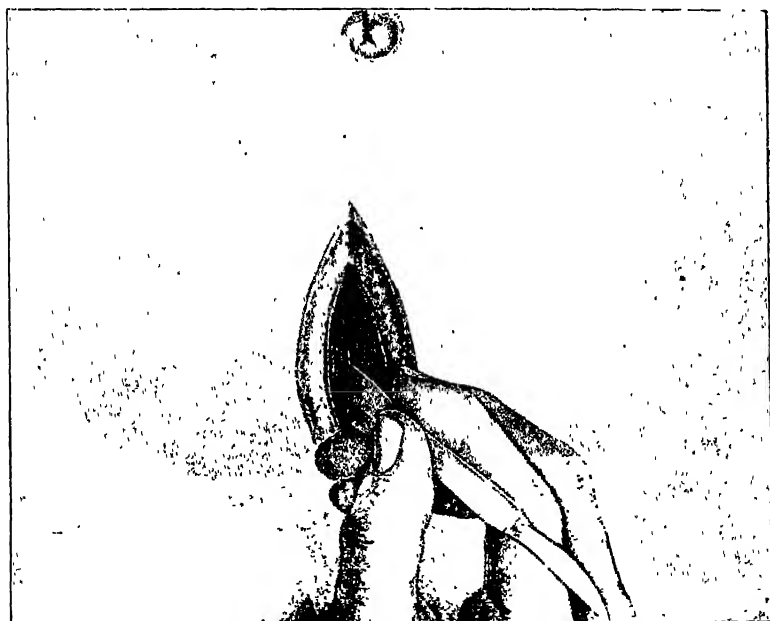


Figure 40.—Suprapubic operation. Separation of the fibres of the rectal muscle with the handle of the scalpel. (Deaver.)

With an urethral catheter in place, scissors or knife may be used to incise the mucous membrane of the most prominent part of the prostate, and the enucleating finger is kept carefully be-

ween the capsule proper of the gland and the inclosing sheath, enucleating from before backward. If the capsule is removed with the gland and the sheath is left behind, the hemorrhage is greatly reduced, all of the gland is removed and the danger of entering the rectum and of infection is minimized. First one side then the other is enucleated, the lobes being removed together or singly. The finger is introduced into the deep urethra to determine if all of the obstruction has been removed. The

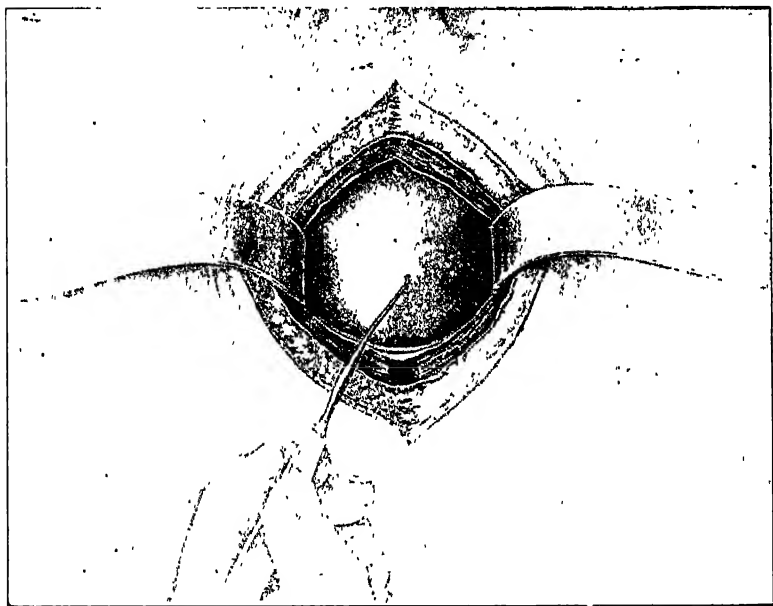


Figure 41.—Suprapubic operation. The bladder has been exposed below the prevesical fold of peritoneum, which can be seen across the upper angle of the wound. A ternaculum steadies the bladder, preparatory to its being opened. (Deaver.)

bladder is flushed freely with hot physiologic salt solution and the cavity from which the prostate was removed is packed for a few moments with gauze saturated with 1 to 1,000 adrenalin chloride solution. After this is removed a two-way retention catheter (Dr. Sage Hardin) is placed in the urethra so that it

drains the prostatic cavity. A good sized rubber tube is placed through the suprapubic incision, which is sewn together snugly, layer by layer. A Penrose cover is placed in the space of Retzius for drainage. Plenty of sterile gauze and cotton are bound



Figure 42.—Siter's prostatectomy knife for incising the capsule of the prostate.

in place with the tube projecting about eight inches for drainage into a bottle to be placed at the patient's side when he has

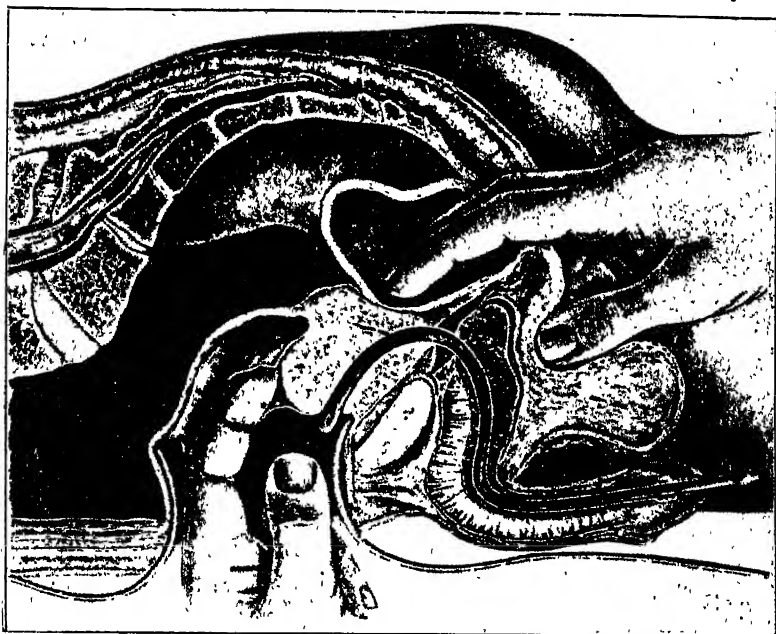


Figure 43.—Suprapubic operation. Sagittal section of pelvis, showing finger enucleating the prostate from its sheath, as counter-pressure is made by the other hand in the rectum and the perineum. (Deaver.)

been removed to his bed. The two-way catheter is allowed to drain into a sterile urinal placed between the patient's thighs.

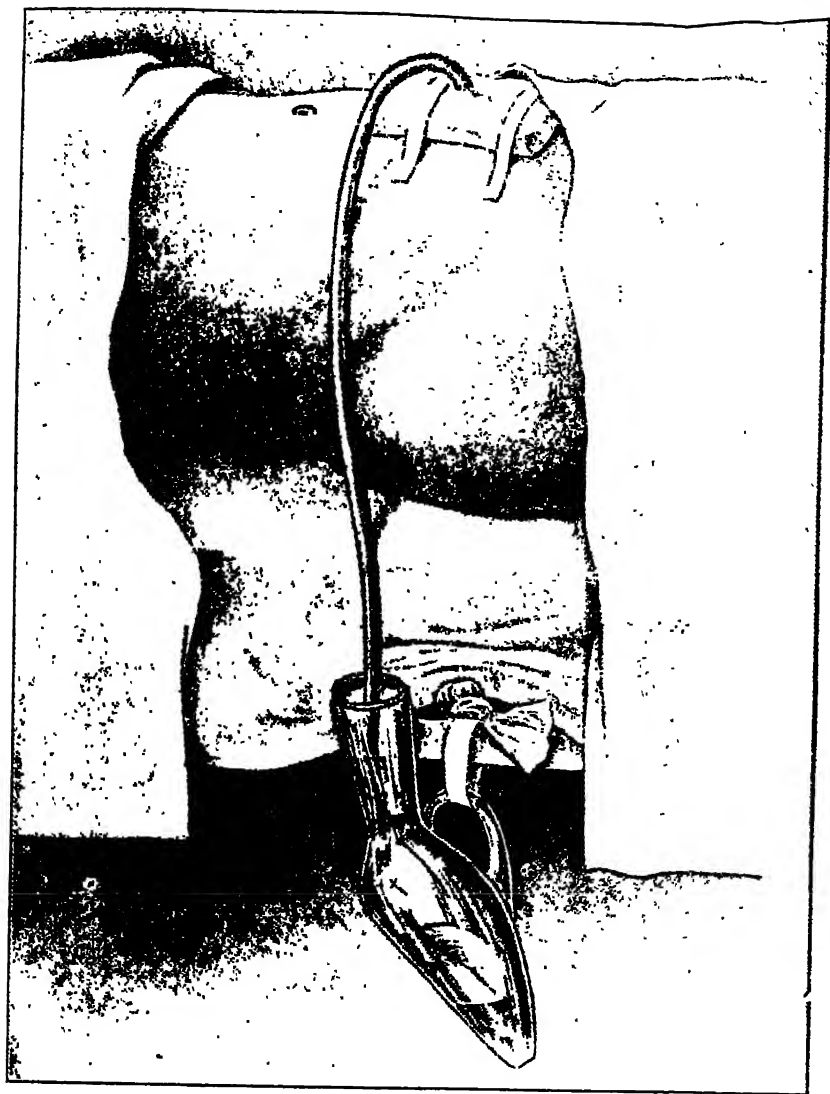


Figure 44.—Suprapubic operation. Drainage-tube and dressing in place. (Deaver.)

Special nurses are secured, and a few ounces of 1 to 10,000 adrenalin chloride solution in hot physiologic salt solution are injected through the catheter and the suprapubic tube every 15

minutes until the hemorrhage diminishes. In about 12 hours the time may be reduced to every  $\frac{1}{2}$  hour and the following day to one hour and finally to two or three times daily until the tube is removed. An ordinary bulb ear syringe, kept in a basin of bichloride, affords a convenient means of injecting the solution into the bladder. With the two-way catheter in the penis, the tube through the wound and the solution injected through them frequently, there is little danger of their becoming blocked with clots. In about a week the tube through the wound may be removed and irrigation continued daily through the opening and the catheter until the fistula heals. The patients should be up as soon as is consistent with their strength and comfort. No instrumentation is, as a rule, necessary after the operation, but bladder irrigations should be continued until the incision heals or until the cystitis (if present) is cured.

**PERINEAL PROSTATECTOMY.**—This operation is usually to be preferred for the glands that are small and fibrous and for those that present toward the perineum rather than into the bladder. The patient is placed in an exaggerated lithotomy position and a median perineal incision is made, or an inverted "Y" or "V" if more space is desired. The central tendon of the perineum is exposed by blunt dissection and then excised, having the finger in the rectum to prevent injury to this viscus. With a sound now in place, an incision is made in the urethra at the apex of the prostate, a Young's retractor is inserted and opened. By blunt dissection and traction the prostate is exposed. With the gland well into view, Young makes two incisions parallel with, and as deep as the urethra, through which each lateral lobe is enucleated. Care is then taken to remove any median mass or other obstruction. After thorough irrigation with hot physiologic salt solution a large catheter is placed in the urethra for drainage and iodoform gauze is placed in each side from which the gland was re-

moved. The muscular tissue is drawn together with ten-day, No. 2 chromic cat gut to restore the perineum and thus lessen the danger of necrosis of the rectal wall, infection, and subsequent fistula.

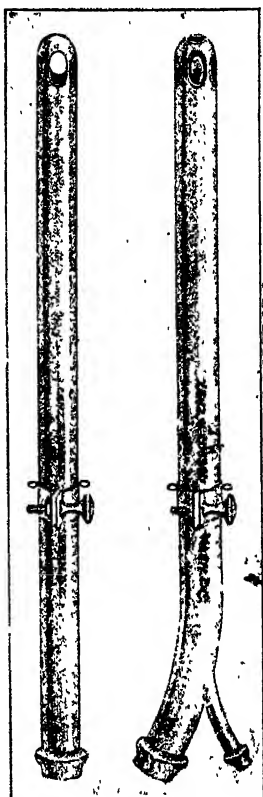


Figure 45.—Hagner's metallic tubes for continuous irrigation after prostatectomy and for drainage after perineal section. It is composed of a larger tube into which a smaller one is incorporated. The latter tube is to be removed in case it becomes occluded. When it has been freed of clots or obstructing debris it should be re-inserted.

If preferred for small glands a median perineal incision may be made and the urethra incised through its prostatic portion and each side enucleated without exposing the gland by dissection. The incision is carefully sutured around a



drainage tube, surrounding which iodoform gauze is placed. It is then dressed with abundant gauze and cotton. Frequent

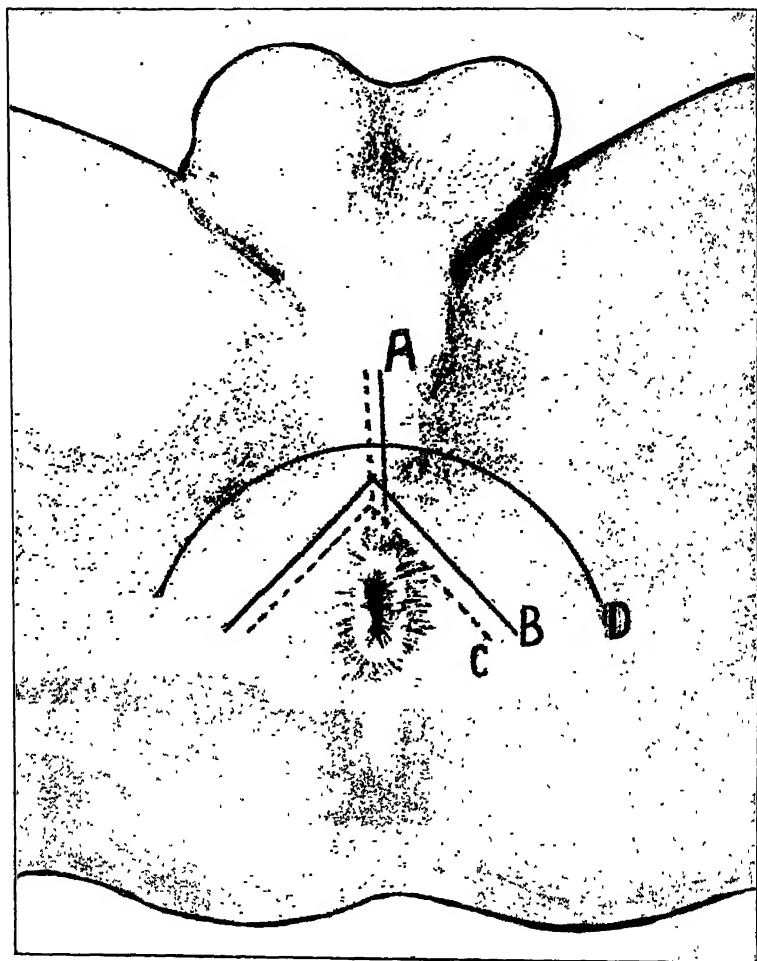


Figure 46.—Incision for Perineal Prostatectomy. A, Median Perineal; B, Inverted V; C, Inverted Y; D, Zuckerkandl's Incision.

injections of salt solution are made through the catheter to wash out the bladder and free it from clots. After two days the drainage gauze is removed from the wound.

The seminal vesicles should not be disturbed if possible by either operation. Sexual potency, however, does not depend upon the presence of the seminal vesicles, but rather upon a number of other factors, such as age, previous condition, general health, etc.

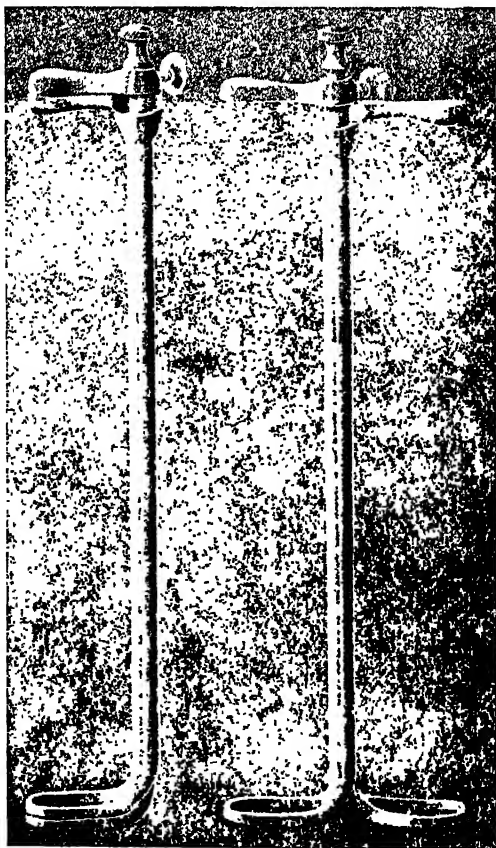


Figure 47.—Young's Prostatic Tractor.

The danger of fistulae is diminished by removing the drainage tubes as soon as the quality of the urine and its free passage through the urethra will permit. To keep the urine flowing freely, diluents and antiseptics should be administered.

Generally the fistula heals in two or three weeks; otherwise it should be scraped out with a curette and the tract swabbed with a strong solution of tincture of iodine or nitrate of silver.

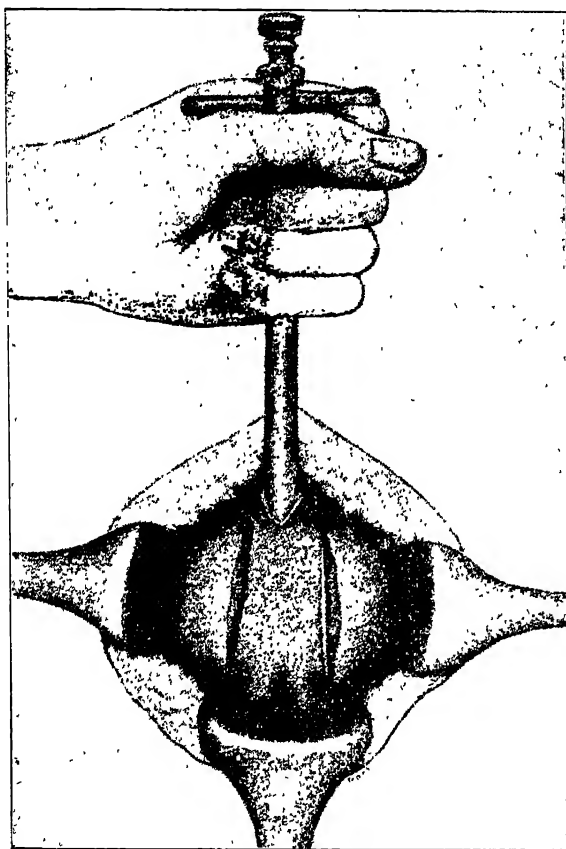


Figure 48.—Tractor introduced, blades separated, traction made exposing posterior surface of prostate. Incision in capsules on each side of ejaculatory ducts. (Young.)

Nourishing diet and proper attention to the bowels are also of importance. Cardiac and general stimulants must be given as indicated. The bladder should be irrigated as long as cystitis persists.

Sparteïn sulphate in 2 gr. doses hypodermically every 6 hours is of distinct value in lessening the danger of suppression of urine, and should be given both in the preliminary treatment and after the operation when any such complication seems likely to occur. If suppression occurs, intravenous injections of physiologic salt solution containing 1 per cent. of carbonate of soda. should be given.

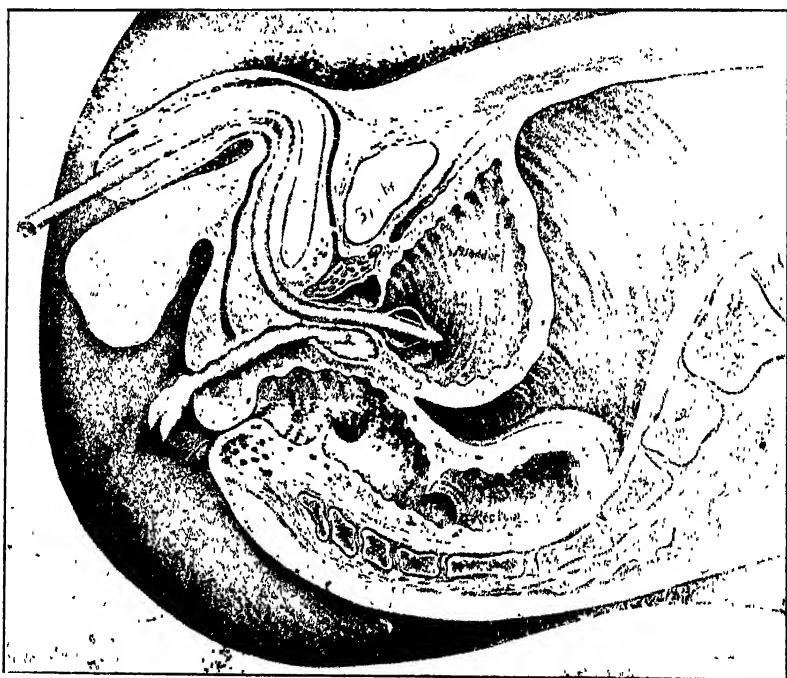


Figure 49.—Drainage in place; 2, gauze packing. (Ferguson.)

CONTRACTIONS OF THE NECK OF THE BLADDER.—The so-called “bar” at the neck of the bladder may cause retention similar to that caused by hypertrophy of the prostate and yet the prostate be normal in size. While the existence of such a condition has been denied by such men as Guyon and those of his school, ample evidence to the contrary has been furnished by Keyes, Chetwood, Young, Fuller and others. Chetwood ad-

vocated, in 1901, a method of dealing with these contractions at the neck of the bladder which he has successfully applied since that time. The method is comparatively simple, as will be seen from his description:

"Local, instead of general, anesthesia may be employed. A small perineal cut is made, which brings the operator close to the site of trouble and allows the introduction of the index-finger to investigate the condition at the neck of the bladder and the degree of existing contraction. The galvanocautery knife is then introduced and, under electrical cauterization, the vesical constriction is incised, on one or both sides, to such an extent as may be deemed advisable; this is accomplished without hemorrhage during or after the operation. The finger may be then reintroduced to ascertain the completeness of the incision or defect thereof; in the latter instance, it may be supplemented by another or longer incision. Finally, rest of the bladder, avoidance of straining, insured by the absence of the necessity to urinate after the operation, the short period of confinement and radical removal of the cause, are all advantages to be counted. By way of comparison, it has been my experience to come in contact in the hospital with a number of patients who have been operated on intravesically without the establishment of perineal drainage. The great distress and complicated condition that ensued in these cases, necessitating the emergency operation of immediate suprapubic drainage to relieve the bladder of distention and infected blood clots, have further strengthened my conviction in favor of this operative technic."

Young has recently devised a "median bar punch" by which he overcomes obstruction as follows:

"The instrument is usually inserted with the cutting obturator pushed home until the end of the instrument is felt to enter the vesical orifice. The inner tube is then withdrawn about 2 cm., the electric light attached externally and an in-

spection made. As a rule, the verumontanum will be seen bulging into the fenestra. The instrument is then pushed slowly inward, the verumontanum is seen to disappear, and the median portion of the prostate gradually enters and finally fills the fenestra completely. If the instrument is pushed a little farther inward, urine escapes, showing that the instrument is in the bladder. When it is drawn outward the flow of urine ceases, showing that the inner edge of the fenestra is caught against the median bar, a good view of which is easily obtained after aspirating the fluid from the interior and drying with swabs. The inner cutting tube is then rapidly pushed home, and excises in one piece the tissues caught in the fenestra. With alligator or rongeur forceps, inserted into the instrument, this piece of tissue is removed and is usually 1.2 to 1.5 cm.



Figure 50.—Guyon's double drainage tube.

long, one-third of its circumference being covered with mucous membrane, partly vesical and partly urethral. Experience has shown that one cut is usually not sufficient, and that it is wise next to turn the instrument first to the right and then to the left in order to remove more of the median bar on each side. The lateral cuts never excise as much as the posterior median, generally about one-third as much. The cutting inner tube is then removed; the bladder is washed out through the outer tube, and when apparently clear of clots the obturator is introduced and the instrument withdrawn. Immediately afterward a two-way urethral rubber or gum catheter is inserted into the blad-

der (by means of a stilet if a gum catheter is used), and continuous irrigation at once begun. If clots are present, they are evacuated by means of a large hand-syringe, but generally that is not necessary. After the double catheter has been fastened in place by means of adhesive strips around the penis, the patient is returned to the ward, where continuous irrigation is at once resumed. A large porcelain tank, containing about 10 liters of sterile water at a temperature of 115 F., which is allowed to flow through a small tube into the bladder and out through the large tube with sufficient rapidity to remove the blood and prevent clotting, is employed. This irrigation is kept up for twenty-four or forty-eight hours. Sometimes the tubes become plugged, and the large hand-syringe has to be used to evacuate the clots. As a rule, the two-way catheter can be removed in from twenty-four to forty-eight hours. Only rarely is further catheterization necessary. Many of the patients have left the hospital in two or three days, several have not even gone to the hospital. As a rule, the patient is able to void urine with much greater freedom at once, and the convalescence is generally rapid and satisfactory, no treatment other than hexamethylenamin (urotropin) and water in abundance being required. The use of sounds and dilators has been found necessary."

Goldschmidt has also devised a cautery with which he incises the median bar through an endoscope.

## TUBERCULOSIS AND CANCER OF THE PROSTATE.

**TUBERCULOSIS OF THE PROSTATE.**—Tuberculosis of the prostate is more frequent in young individuals with a hereditary predisposition, and especially in those with a chronic gonorrhoeal prostatitis. It is comparatively rare in the South. There is usually a tuberculous condition in other organs of the body, as the lungs, kidneys, epididymes, etc. It is not clearly

understood how the infection reaches the prostate. The pathologic changes vary much as do the prostates affected with a gonorrhoeal inflammation. At the beginning nodules form and later undergo caseous degeneration. Secondary infection may occur and result in abscesses. The gland is usually enlarged

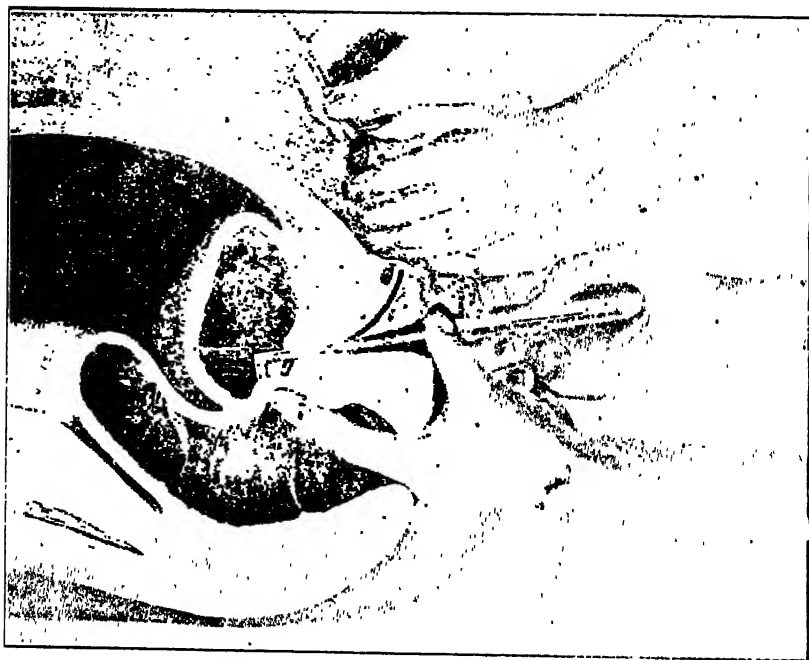


Figure 51.—Chetwood's operation. (Guiteras.)

and nodular. There are no characteristic symptoms of tuberculous prostatitis to differentiate it from that of gonorrhoeal origin. It is worthy of note that there is likely to be terminal hematuria and blood stained semen, but these also occur in other inflammations. It is claimed that instillation of nitrate of silver increases the hemorrhage and intensifies the pain when it is due to a tuberculous process, while the reverse is true of gonorrhoea. Deaver thinks that isolated nodules in the prostate occur in no other condition and that they are characteristic of



tuberculosis. The gland is also excessively sensitive to pressure. The entire history, symptoms and physical signs should be considered in making a diagnosis. In an advanced process, where abscesses have ruptured and fistulae persist, we are usually safe in assuming tuberculosis to be the cause, unless the facts point clearly in the contrary direction.

The prognosis depends largely upon the associated lesions. There are few diseases more painful and more unbearable than tuberculosis of the bladder, which may arise as a complication or in conjunction with tubercular prostatitis. Generally, tubercular prostatitis is more likely to progress than to improve.

Treatment is of little avail. The general hygienic measures as employed in other forms of tuberculosis are indicated. The symptoms and complications must be treated according to general surgical principles. Abscesses and fistulae should be opened through a perineal incision and swabbed out with tincture of iodine.

**MALIGNANT GROWTHS OF THE PROSTATE.**—Sarcoma has been observed occasionally in childhood, but it is largely with carcinoma in the aged that we have to deal. There appears to be both a soft adeno-carcinoma (rare) and a hard lobulated carcinoma which affect the prostate, and probably more frequently than is generally believed. Prostatic cancers have a peculiar tendency to produce abundant and widely disseminated metastases in the bones.

Carcinoma of the prostate, as a rule, has two characteristic symptoms, severe pain independent of urination, and stone-like hardness. There may be marked irregularities on the rectal surface and the mucous membrane may be adherent. As the disease progresses the surrounding tissues become infiltrated. The persistent severe pain, cachexia, painful defecation, and perhaps bloody urine should suggest the likelihood of cancer in spite of the fact that the urinary symptoms are so similar to

those of prostatic hypertrophy. These patients steadily grow worse, becoming pale and emaciated. They are saved only by early diagnosis and a radical operation.

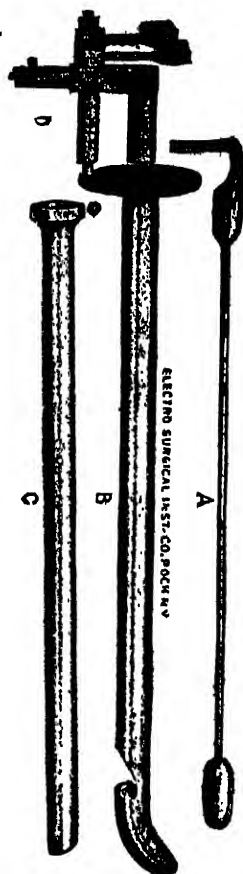


Figure 52.—Young's punch for fibrous contraction at the neck of the bladder.

TREATMENT.—When the disease is far advanced the treatment is merely symptomatic and palliative. Morphine, codeine, hyocyamus, and such drugs should be given as indicated to relieve pain; hot baths and hot applications also may be of value for this purpose. The only feasible operation is a very radical

one, performed before infiltration of surrounding tissue or metastases contra-indicate it, or permanent suprapubic drainage with a catheter, inserted as previously described through a cannula or through a retention catheter. Young has performed and described the most satisfactory complete extirpation, for full description of which see Johns Hopkins Bulletin, Vol. XIV.

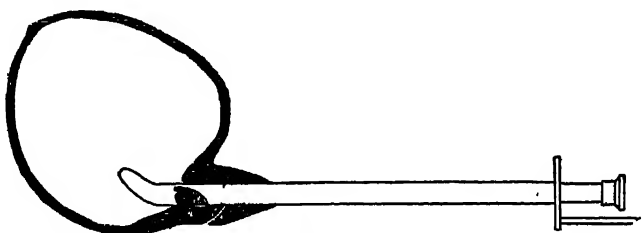


Figure 53.—Young's punch with contracted neck of the bladder engaged.

**SUMMARY.**—Preliminary treatment is often of prime importance to bring the patient's general physical state to the best possible condition, especially as regards his kidneys and lungs. Satisfactory renal activity cannot, at times, be obtained without relief of residual urine by permanent urethral or suprapubic drainage. Unless contra-indicated, cystoscopy should be done and the presence of stones and other complications determined before the operation. A short anesthetic greatly lessens the danger of pulmonary complications. In making the incision for the suprapubic operation the bladder should be well distended; the fat and peritoneum should be pressed upward with gauze so as not to enter the peritoneum. With a catheter in the urethra, the mucous membrane over the most prominent part of the prostate is incised. The gland and its capsule are enucleated from the inclosing sheath. The bladder is flushed freely with hot physiologic salt solution. A two-way urethral catheter is placed in the urethra and a tube of good size is fixed in the suprapubic incision. A weak solution of adrenalin

chloride is injected into the bladder at very frequent intervals until the hemorrhage diminishes.

The perineal operation requires a careful blunt dissection through the tissues, exposing and incising the central tendon of the perineum—the finger being in the rectum to prevent its injury.

By further blunt dissection and traction with a Young's tractor placed in the urethra through an incision at the apex of the prostate, the glands are exposed. Over each lobe an incision is made through which they are removed. The cavity is packed with iodoform gauze and a tube is placed through the wound into the bladder or through the urethra into the bladder, the incision is closed around the tube and drainage. Salt solution is injected frequently to wash out the bladder and free it from clots. The drainage is gradually removed.

Tuberculosis of the prostate is rare and is usually associated with tuberculosis of other organs of the body.

Malignant growths of the prostate are not infrequent and require prompt excision. The diagnosis is often difficult or impossible until the specimen is examined by the pathologist.

## CHAPTER XVI

## SEMINAL VESICULITIS.

CAUSES, SYMPTOMS, DIAGNOSIS, PROGNOSIS, TREATMENT OF ACUTE  
AND CHRONIC SEMINAL VESICULITIS, VASOSTOMY,  
SPERMATORRHOEA, ETIOLOGY, SYMPTOMS,  
TREATMENT, AND SUMMARY

Seminal vesiculitis was first recognized as a pathologic entity by Lloyd, in 1889, and since that time its correct diagnosis has cleared up many of the puzzling features of the so-called urinary and prostatic disorders. Although a very common complication of deeply seated chronic gonorrhoeal infection, unfortunately it is frequently overlooked. Wiltse has also

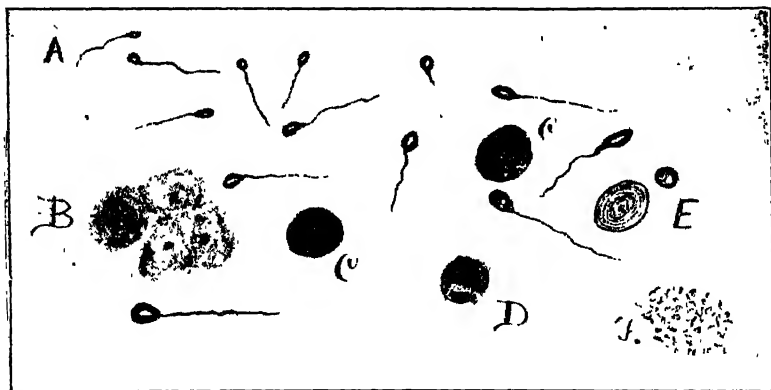


Figure 54.—Normal semen. A, spermatozoa; B, epithelial cells; C, seminal cells; D, leukocyte (occasional); E, amyloid body; F, granular phosphates.

emphasized the importance of recognizing the simple or catarrhal seminal vesiculitis, which is often neglected, or looked upon as a neurosis.

**CAUSES.**—Certain predisposing factors are important in the etiology of vesiculitis. Masturbation, frequent or prolonged ungratified sexual desire, coitus interruptus, and, in fact, anything that tends to produce a chronic congestion of the genital organs favors bacterial infection. The most frequent cause is the extension of gonorrhoeal infection from the deep urethra. The colon bacillus and other pyogenic germs, also

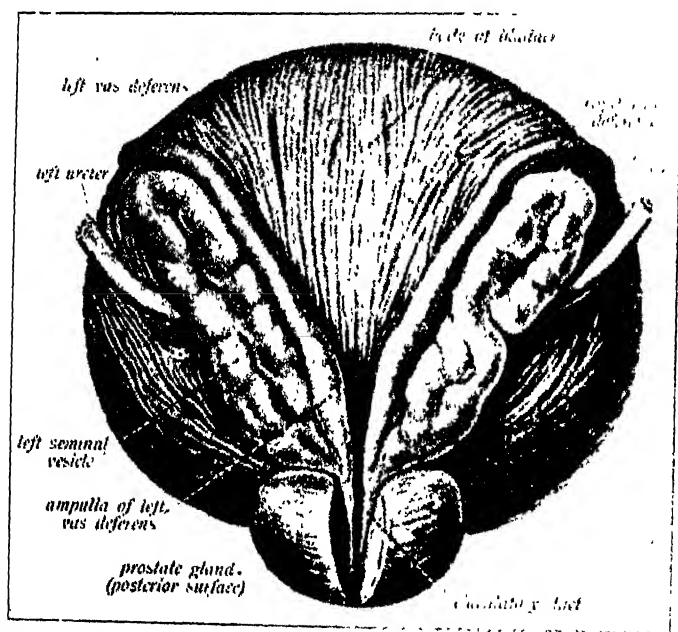


Figure 55.—The urinary bladder with the seminal vesicles, the ampulla of the vasa deferentia, and the prostate seen from behind and below. The prostate is partly divided longitudinally. (Sobotta and McMurrich.)

may produce vesiculitis. Tubercular inflammation of the bladder, epididymis, testicle or prostate may extend to the vesicles. Ordinary pyogenic infection may be introduced on septic instruments and produce a deep urethritis or cystitis, which may then extend to the vesicles. Bicycle riding is thought to be a contributory factor in the production of the disease.

**SYMPTOMS.**—Vesiculitis may be acute or chronic. The acute begins with practically the same symptoms as those observed in acute posterior urethritis. Urination is frequent and painful, and there may be a feeling of tension or fullness in the perineal region. Defecation is painful, and may be attended with an increase in the urethral discharge. Well marked tenesmus is sometimes present and is characteristic of vesiculitis when it is worse than the urethral and bladder inflammation would lead one to expect. We have seen one patient in whom the tenesmus was most annoying, and yet the urine remained almost clear, the ducts of the vesicles being apparently occluded by the inflammatory edema. Pollutions are frequent and painful, and sometimes may occur during the day, and perhaps contain blood. When severe, the inflammation enters the vas deferens and produces symptoms like a beginning epididymitis. Spermatozoa may be found in the urine. Rectal palpation is painful, and tender, hot, indurated or fluctuating vesicle may be felt just above the prostate gland. There are usually fever, backache, anorexia and constipation. An abscess may form, but rarely ruptures externally.

Chronic vesiculitis may occur as a sequel of the acute form, or may arise insidiously. There are practically no subjective symptoms in the chronic inflammation, except perhaps a chronic irregularly persistent urethral discharge, itching, burning or pain in the urethra and frequent urination. There are few more unsatisfactory or more persistent conditions in the entire domain of medicine. Any of the symptoms of chronic prostatitis should lead to an examination of the vesicles as well, for they are frequently affected simultaneously.

Of all the causes of genuine spermatorrhoea, chronic vesiculitis is by all means the most important. The increase in the secretion produced by the inflammation soon distends the vesicle, and the overflow constitutes a true spermatorrhoea, the spermatozoa being mechanically washed out by the discharge. This

secretion contains pus and albumose, just as does the secretion from an inflamed prostate, but as all semen contains a small amount of albumose, its presence is not of special diagnostic value.

**THE DIAGNOSIS.**—Acute seminal vesiculitis is easily diagnosed by rectal examination. We are thus enabled to differentiate it from prostatitis. The diagnosis of chronic vesiculitis requires much more care, unless the enlargement is of sufficient size to be palpable. The bladder should be distended to force down the vesicles as much as possible, and the examination made with the patient in a dorsal position, with the thighs flexed well up on the abdomen. The normal vesicle rarely can be detected by palpation, and if a soft tumor can be felt above the prostate and on the base of the bladder, it may be considered a distended and probably a chronically inflamed vesicle. A positive diagnosis may be obtained by the following method: The patient urinates in order to wash out the urethra, but retains some of the urine which is to be voided after the prostate has been massaged. Care should be taken not to press on the vesicles. An examination of the urine passed will show the condition of the prostate. The urethra and bladder are now irrigated with normal salt solution and the bladder filled with the fluid. Another rectal examination is made, the operator reaching above the prostate and pressing several times from above downward, to milk the contents from the vesicles. This secretion which appears at the meatus, or is passed out in the fluid, will show by the presence of pus that the vesicles are inflamed, or by its absence that they are not. Many spermatozoa are seen, both alive and dead, as well as seminal cells, lecithin bodies, desquamated epithelia, granular phosphates, debris, and occasionally laminated amyloid bodies.

Saxe says the semi-solid bodies in massage urine, derived from the vesicles, include sago bodies, sugar granules, skins



vesicular casts and vesicular shreds; and that neither the occurrence of semi-solid masses nor the increased amount of material from the vesicles necessarily indicates the presence of vesiculitis. The diagnosis of vesiculitis is incompletely founded, unless stained smears from the semi-solid vesicular bodies (when such are present) show the presence of sufficient numbers of pus cells, of vesicular epithelia and of bacteria to warrant such a diagnosis.

THE PROGNOSIS of acute seminal vesiculitis is good, so far as the acute symptoms are concerned, but the subacute and chronic affections have a great tendency to persist. Fuller has shown that gonorrhoeal rheumatism is likely to be caused by inflammation of the vesicles. Acute vesiculitis may be followed by the chronic form which is always difficult to cure.

TREATMENT.—The acute disease requires rest in bed with the pelvis elevated and hot sitz baths or hot fomentations over the bladder and the perineum. Cold irrigations of normal salt solution may be used early in the disease. (The water should be cooled gradually, from 90 degrees to 60 degrees.) After the process is well established, or from the beginning if preferred, the irrigations may be administered hot, a temperature of 110 degrees to 115 degrees being sufficient. These should be given with two soft rubber catheters; one is attached to a fountain syringe, and the other allows the escape of the fluid from the rectum. The irrigations may be administered once or twice daily, if well borne; otherwise, they should be discontinued. Oil of sandalwood, balsam copaiba, hyocyamus and belladonna may be administered internally, or the last two, combined with opium, in suppositories, per rectum. Aronstam recommends the following formula for the distressing symptoms and tenesmus:

R.	Sod. salicylat. ....	4.	3i	85
	Potass. acetat. ....	20.	3v	25
	Urotropin. ....	45.	3iss	40
	Tinc. hyocyami ....	15.	3ss	30
	Elix. auranti. q. s. ad ....	120.	3iv	3

M. Sig. Two drachms every four hours, in water.

Also:

R.	Liq. adrenalin (Sol. 1,000) .....	1.5	m xxiv
	Pulv. opii -----	.6	gr. xi
	Ext. belladonae -----	.09	gr. iss
	Olei theobrom. ....	qs.	
	M. et. ft. suppos. No. xii.		

Sig.: One, three or five times daily.

The diet should be light and nourishing and, of course, alcohol and highly seasoned foods should be withheld. The bowels should not be evacuated too freely, for fear of intensifying the inflammatory symptoms.

When the swelling and pain persist, Tuttle asserts that counter irritation over the vesicles through the rectal speculum gives great relief, and often starts up resolution where nothing else will. This accomplished by applying to the rectal mucosa over the inflamed vesicles a 5% solution of silver nitrate with an applicator wrapped with cotton.

Vaccine therapy or phylacogen often gives satisfactory results in acute seminal vesiculitis.

Too frequent examinations as well as overtreatment must be avoided. Urethral medication should be discontinued during the acute stage.

THE TREATMENT OF CHRONIC VESICULITIS.—This is one of the most intractable diseases with which we have to deal. Massage, vaccine, therapy and Belfield's vasostomy are the chief measures for combating it. The diet, hygiene and general man-

agement, including the use of bacterins, are practically the same as in chronic prostatitis.

The ducts from the seminal vesicles may be patent, partially occluded, or entirely blocked by stricture or hardened detritus. Naturally, the treatment must depend upon the condition present. Where the ducts are partly or completely occluded, of course massage can be of little value.

Digital massage of the vesicles may be performed once or twice weekly and the interval gradually increased to one treatment a month until the patient is cured or until vasostomy is done. In order to reach the vesicles a long finger is necessary or the treatment is practically useless. A distended bladder serves a double purpose, however, in that it depresses the vesicles and washes out the debris after the secretion has been expressed. The patient lies on his back with his thighs well flexed or stoops over a chair; the surgeon introduces his forefinger well into the rectum and massages, not roughly but firmly, from above downward a number of times, the vesicles and the prostate. All complicating urethral, prostatic and bladder disorders should be treated. Much that has been said concerning the management of chronic urethritis and prostatitis applies also to vesiculitis.

After all infection has disappeared, regular, normal intercourse is beneficial in clearing out the secretion which is apt to be excessive in amount and to remain so for years. Of course, extraordinary care should be taken to demonstrate that all gonococci have disappeared before giving the patient permission to marry. See the method of determining if any are present.

**VASOSTOMY.**—Belfield first suggested medication of the vas, ampulla and seminal vesicles by injecting solutions through an incision into the vas deferens. His method is essentially as follows: The vas deferens can easily be brought by the finger against the skin of the scrotum and held there by a

half curved needle passed through the skin under the vas. A half-inch incision through the skin and envelopes of the spermatic cord—painless under local anesthesia—exposes the vas. The vas should be firmly fixed before the incision is made and it should be dissected entirely free from its sheaths before incising it, otherwise difficulty may be experienced in finding the lumen of the vas. A longitudinal incision into the vas opens its canal. The blunted needle of a hypodermic syringe can be passed into this minute canal and a watery solution of any desired medicine injected; this liquid traverses the vas and the ampulla, and distends the seminal vesicle. The first injection should not exceed 30 minims. The best solutions are 5% argyrol, 1% protargol, or 1-2000 silver nitrate. Considerable pain may follow if strong solutions are injected or if the amount is too great.

The operative procedures, such as vasostomy, incision or excision, become necessary, unless the vesicles are readily emptied by massage. Even where the ducts are patent convolutions may be so arranged as to render it impossible to empty the vesicles by the massage. Operative measures may also be required to prevent recurrent epididymitis and in the treatment of gonorrhoeal rheumatism as suggested by Fuller.

Regarding vasostomy, as described by Belfield, Herbst reported 104 of such operations, eighty-eight patients, thirty two being bilateral; eleven were due to ordinary pyogenic organisms; seventy-seven were of the post-gonorrhoeal type. He says further:

"The vas was kept open for from seven to twenty-one days. Injections were made daily; in a few instances, twice a day for the first few days after operation. The mild silver salts were first used and were followed by the more astringent salts. Of the eighty-eight cases, fourteen passed from my control before I could ascertain results. Of the eleven cases due to ordinary pus infection, ten are cured; one patient still complains of colic

following urination, though he affirms that it is less severe than before the operation.

"I was able to control sixty-three of the seventy-seven post-gonorrhoeal cases. The gonococcus was demonstrated in the gleet discharge, in the expressed secretion from the prostate and vesicles or in the ejaculated specimen of semen. In the event that the cases were complicated by a stricture, folliculitis or prostatitis, these conditions were treated before the operation was performed. The duration of the post-gonorrhoeal condition varied from three months to eight years.

"Many of the older cases had gone through several acute exacerbations. Forty-one of the sixty-three patients were cured by vasostomy; i. e., their symptoms disappeared and I was unable to demonstrate the gonococcus either in the expressed prostatic and seminal secretion or in the ejaculated seminal discharge. Of the twenty-two cases that did not clear up after the operation, three patients were free from gonococci, but still complained of some pain and frequency of urination. One of these, however, improved after a thorough course of massage of the prostate. Of the nineteen cases in which gonococci were still present after vasostomy and lavage, seven cleared up after massage and instillation into the posterior urethra. In twelve cases I was unable to eliminate the gonococcus. It is my opinion that in some of these the gonococcus was harbored in some of the inaccessible recesses of the prostate gland.

"If I may be allowed to eliminate the fourteen cases that passed from my control, in fifty-one of the seventy-four cases the cure may incontestably be attributed to vasostomy, which is a percentage of 67. This may not appear at first sight to be a strikingly high proportion, but if the class of cases be taken into consideration I am certain that most of them would heretofore have been designated as cases of incurable post-gonorrhoeal seminal vesiculitis."

**SPERMATORRHOEA.**—Abnormal loss of semen may occur during the night or during the day as a pollution, or the semen may escape gradually as discharge, which is known as spermatorrhoea. Nocturnal emissions are normal if they occur only one or twice a week, and are not followed by a feeling of depression or weakness, but when unduly frequent and not accompanied by firm erections and the usual sensation, and if, subsequently, the patient feels weak, debilitated, and irritable, these pollutions may be considered pathologic. The usual cause is a hyperesthetic condition of the sexual organs or nerve centers brought about by inflammation or congestion of the pelvic organs. The impressions sent up by the nerves are exaggerated by the sensory terminals or by the centers which receive them so that the discharge takes place from slight stimulation. Among the causes of abnormal emissions, nocturnal or diurnal, are gonorrhoeal inflammation of the deeper structures, masturbation, withdrawal before ejaculation and neurasthenia. Diurnal emissions from slight mechanical or physical stimuli are symptomatic of a diseased condition, and are never to be considered normal.

The semen discharged is a composite secretion from the testicles, vas deferens, seminal vesicles, prostate gland, Cowper's glands and from the mucous glands of the urethra. It is a tenacious, milky, opalescent fluid, alkaline in reaction, if tested with litmus, and has a peculiar characteristic odor. It is composed of about 5% solid organic elements, 3% calcium phosphate, 1% sodium salts, 90% water, and traces of magnesium phosphate and ammonium phosphate.

Microscopically the most striking feature of semen is the active movement of the spermatozoa which are present in enormous numbers. Each spermatozoon consists of a flat head, a neck and a long thin tail, which has a constant lashing movement. Water, acids, and urine quickly destroy them; alkalis favor their mobility.

The secretion from the seminal vesicles and the prostate gland dilutes and enlivens the sperm secretion from the testicles. The alkaline prostatic fluid seems necessary for the preservation of the spermatozoa in the vagina. In addition to the spermatozoa may be seen granular phosphates, mononuclear cells, desquamated epithelial cells, lecithin bodies, amyloid bodies and an occasional leukocyte.

**ETIOLOGY.**—Spermatorrhoea is, in the large majority of cases, due to an inflammation of the seminal vesicles. This inflammation causes an increase in the secretion which distends the vesicles and is finally discharged as an emission, or gradually leaks out at the meatus or backward into the bladder. The prostatic secretion is much more frequently expressed as a discharge resembling a loss of semen, from which it may be readily differentiated by the absence of spermatozoa. Much misapprehension prevails both among the laity and the profession regarding the significance of these discharges; the patient frequently believes them to be a direct leak from his spinal cord or brain and that they are a stupendous drain upon his vitality, while the average physician too frequently examines the secretion and if spermatozoa are absent he makes no further effort to treat the condition. According to the writers' experience, about as much harm is caused by prostaticorrhoea as by spermatorrhoea.

Real spermatorrhoea, as a rule, may be regarded as resulting from a mild inflammation of the seminal vesicles, which produces an increase in the secretion and carries with it the spermatozoa as it passes out. This conception of spermatorrhoea will insure more satisfactory results than will treatment directed toward the nervous or general system. It is not the dilation or paresis of the seminal ducts, but the excessive secretion produced by the vesicles that causes the escape of the fluid containing the spermatozoa. Rarely real spermatorrhoea may

result from some spinal defect, as locomotor ataxia or mental disorders. Frequently these latter conditions are associated with chronic inflammation of the prostate and vesicles, and, to a large extent, are dependent upon them. This is especially true of sexual neurasthenia with its various symptoms. A supposed spermatorrhoea and sexual weakness are always closely allied to sexual neuroses.

THE SYMPTOMS vary according to the cause: deep urethritis, prostatitis, vesiculitis, masturbation, coitus reservatus or frequent prolonged ungratified sexual desire. There may be local symptoms, as pus and shreds in the urine, an enlarged, hyperæsthetic verumontanum, a spasmodic condition of the urethral sphincter, sexual irritability or weakness, premature ejaculations or imperfect erections and frequent nocturnal or diurnal pollutions.

In addition there are the neurasthenic symptoms, circulatory and digestive disturbances, pain in the lower portion of the spine, especially in the sacral region, pain above the symphysis pubis or down the thighs and neuralgia of the lumbosacral plexus. General neurasthenia and that of sexual origin are very similar, but the history and a careful examination for genito-urinary disorders will usually enable one to decide between these conditions.

The usual symptoms are mental and physical depression, irritability, poor memory, loss of power of concentration of the mind, lack of ambition or inability of sustaining prolonged effort, moroseness, unrefreshing sleep, loss of appetite, restlessness, an unfortunate tendency to introspection, and many other similar or allied symptoms.

TREATMENT.—The treatment should include the remedies necessary to cure whatever lesion is present, such as deep urethritis, prostatitis, seminal vesiculitis, calculi, stricture, etc. Ergot



in 5 to 8 minim doses at bedtime lessens the frequency of nocturnal emissions. Prostatic massage, the use of the Kollmann dilator and deep instillations are often promptly effective if the lesions previously mentioned are absent. Local endoscopic applications of 2% solution of nitrate of silver to the verumontanum are often of value.

**SUMMARY.**—Although a rather frequent complication of chronic, deepseated gonorrhoea, seminal vesiculitis is frequently overlooked. This affection may be acute or chronic in character and present symptoms of, and often is associated with, inflammation of the prostate gland. The diagnosis is made by palpation, the vesicles being enlarged and tender, and by the presence of pus in the secretion expressed. The treatment of the acute inflammation consists of rest, hot sitz baths, hot rectal irrigations, vaccines and phylacogen.

**CHRONIC SEMINAL VESICULITIS** is often the source of recurrent gonorrhoeal infection and may cause troublesome gonorrhoeal rheumatism which may require drainage of the vesicles to cure. The symptoms are not characteristic and the vesicles should be examined as part of the routine examination of all chronic inflammations. The diagnosis is made by the detection of pus cells in the secretion expressed from the vesicles. The prostate should be previously massaged and the bladder washed out with a boric acid solution. The bladder is filled and the vesicles then massaged, avoiding pressure on the prostate. The secretion pressed out or the fluid voided after massage should be examined for pus cells and micro-organisms. The treatment depends largely upon whether or not the ducts opening into the urethra are patulous or not. If they are open massage, vaccines, phylacogen and hot sitz baths may effect a cure. The result is usually slowly attained and may require prolonged treatment. If the openings are not patulous, operative

treatment may be required. This may consist of Belfield's drainage and medication through the vas deferens or of Fuller's seminal vesiculotomy.

LOSS OF SEMEN usually means a mild chronic inflammation of the seminal vesicles or a hyperesthetic or chronically inflamed deep urethra. The treatment should be directed toward pathologic lesions of the genito-urinary tract. The prostate gland and seminal vesicles should be massaged, and the deep urethra should be treated with Kollmann dilation and endoscopic applications of silver nitrate. For frequent nocturnal emissions ergotole, in 5 to 8 minim doses at 4 p. m. and at bedtime, is the best internal remedy.

## CHAPTER XVII

## SEXUAL NEURASTHENIA

PHYSIOLOGY OF ERECTIONS, CAUSES OF SEXUAL NEURASTHENIA,  
PROGNOSIS,

SEXUAL IMPOTENCE,

VARIETIES, TREATMENT

## INCONTINENCE OF URINE

ETIOLOGY, PROGNOSIS, TREATMENT, AND SUMMARY

**PHYSIOLOGY OF ERECTIONS.**—This phenomenon is under nervous control and is evoked by stimulating the brain, the lumbar cord, and the sensory nerves of the genital organs. The exact mechanism of erections is not clearly understood, but it is known to be dependent upon an engorgement of the blood vessels of the corpora cavernosa, by an afflux of blood probably due to a reflex dilation of the arteries and vascular spaces of the body of the penis, and to a simultaneous checking of the venous flow. (Casper.) The reflux of blood is prevented by muscular contraction around the proximal portions of the veins and the pressure exerted by the distended corpora cavernosa. Co-habitation, copulation or coitus is the act of depositing the semen within the vagina near the mouth of the womb. Ejaculation or orgasm is the term applied to the "crisis of voluptuous sensation when the semen is expelled from the ejaculatory ducts into the urethra."

As sexual neurasthenia is closely related to this subject and requires somewhat the same line of treatment, it is expedient to discuss its salient features before outlining the management of sexual weakness. Any form of neurasthenia may

for it is impotentia coeundi, in contra-distinction to impotentia generandi, which implies sterility of the semen. A man may be potent sexually, and yet not have the power to procreate, or he may have active spermatozoa in his semen but lack the power of copulation. Casper subdivides impotentia coeundi, according to the cause upon which the impotence depends, as follows: 1, Organic; 2, Psychological; 3, Nervous; 4, Paralytic, and 5, Atonic.

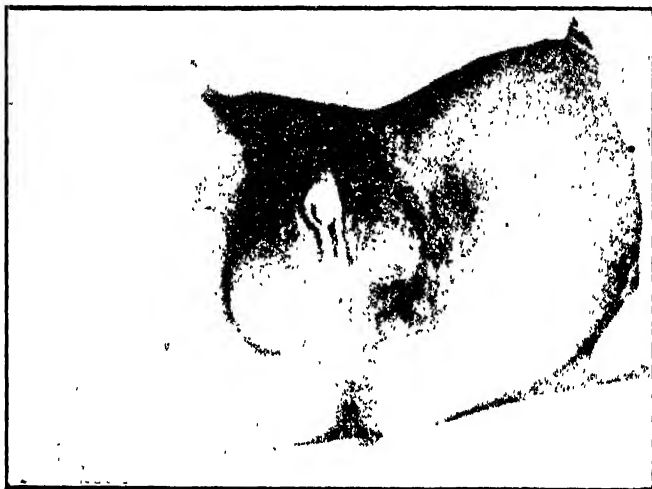


Figure 56.—Hypospadias, resembling hermaphrodite.

ORGANIC IMPOTENCE.—Organic impotence depends upon malformation or defect of the genital organs or neighboring structures. This form of impotence is caused by a rudimentary penis, ossification, fibroid, sclerosis or tumors of the penis epispadias, hypospadias, large hydrocele, scrotal hernia, elephantiasis and such conditions.

Psychical impotence is applied to sexual weakness caused by a certain state of mind or by mental impressions, and constitutes a very important phenomenon. The term includes only those in whom the dominating influence is mental and not those patients whose local lesions are sufficient to account for the symptoms. There is great diversity in the symptoms and causes,

as well as in the degree and character of the impotency. Absence of the normal sexual impulse may be lacking. This may be congenital or acquired. The latter form may be the result of mental overwork, worry, grief, anxiety or fear. In the majority of cases it is weakness of the genitalia or nervous system resulting from excesses or masturbation which leads to impotence, in addition to the lack of self-confidence and fear that former digressions may have inflicted harm.

Disgust and aversion may be produced by soiled linen, uncleanness or a disagreeable odor, and thus prevent the normal erection. Perverse sexual desire may cause impotence on account of the fact that these patients are aroused only by an unusual sight, article of apparel, or something of the kind which is necessary to evoke an erection, but probably not available at the time of intercourse. Some individuals may obtain sexual gratification by the mere contemplation of certain inanimate objects (fetishism); others must commit some horrible crime, frequently by mutilation, to gratify an unnatural sexual li t (sadiism). Homosexual perversion is love for those of the same sex and is character frequent occurrence (sodomy). If the victim be a boy, it is called pederasty. Masochism is a condition in which the pervert takes delight in being subjected to degrading or humiliating acts on the part of his associate. Satyriasis and nymphomania are conditions characterized by an overpowering desire for sexual gratification.

Nervous impotence is often associated with sexual neurasthenia, and is a functional deficiency rather than a pathologic anatomic one in which lesions are demonstrable. There is an excessive nervous activity, and ejaculation may take place immediately upon intromission or before this has been attained. Pollutions are likely to be unduly frequent, depressing and weakening. The verumontanum and deep urethra are hyperesthetic and the prostate is nearly always found to contain myriads of attenuated organisms.

The symptoms are frequently produced by true inflammatory conditions of the genital organs, and, therefore, the diagnosis and treatment should never precede a careful search for such local lesions.

Atonic impotence may be of short duration and curable, and is usually caused by debilitating diseases, sexual excesses and the effect of certain drugs. The following diseases cause more or less impotence: Bright's disease, diabetes, gastro-intestinal disturbances, anemias, typhoid fever, diphtheria, influenza, pneumonia, malaria, uremia, rheumatic fever, cerebro-spinal meningitis, erysipelas, obesity, etc.

Sexual excesses, especially masturbation before maturity and abnormal sexual gratification, are potent factors in the production of impotence of the atonic as well as psychic and nervous forms. Alcohol and opium in excess, bromides, iodides, excessive use of tea, coffee and tobacco, lead, arsenic, camphor, potassium nitrate and salicylic acid are said at times to cause impotence.

Paralytic impotence is due to structural lesions of the brain and cord affecting the nervous and muscular apparatus of the genital organs. Paralytic impotence is usually complete and permanent.

In the early stages of locomotor ataxia there may be undue sexual excitement, but later the sexual power declines and the patient becomes completely impotent.

**TREATMENT.**—Organic impotence, of course, calls for correction, if possible, of the deformity. Psychical impotence is worthy of much consideration. The patient stands much in need of encouragement and strong assurance that his condition is amenable to treatment. Good hygiene, fresh air, exercise, amusements, cheerful company and travel are of value in improving the general health and in preventing the mind from dwelling continually upon the disease.

Careful examinations are important in giving the patient the confidence which is so essential for a successful result. Diseases of the urethra, penis, prostate, vesicles and bladder should be appropriately treated for any abnormality found; stimulating drugs should be given, and among the most useful are strychnia .002 (1-30) grain and quinine .2 (3 grains), three times daily, with or without phosphorus .0006 (1-100) grain, or about 10 minims of tincture of cantharides. These should not be administered for any length of time and always after considerable sexual rest and a course with tonics, with a positive injunction to refrain from any attempt at coitus. To these directions heed will be given for a time, but later, when erections have become frequent and firm, the patient will find that intercourse can be indulged in satisfactorily. Permission to make this effort should not be given for two or three months, as forbidden fruit is apt to be most enjoyable, and success is more likely to follow an attempt without permission than with it.

Taylor recommends the following prescription:

R	Ferri et quininae citrat. -----	12.	℥iii
	Fl. ext. cocae -----	60.	℥ii
	Tr. gentian. comp. -----	45.	℥iss
	Tr. nucis vomicae -----	6.5	gtts. c
	Aquae -----	15.	℥ss

M. Sig.: One teaspoonful in a wine glass of water, three times a day, one hour after meals.

As previously mentioned in the treatment of neurasthenia Kollmann dilation to 38 to 45 often works like magic and probably gives more satisfactory results than any single treatment. Vecki-recommends local applications to the deep urethra with tincture of ratanae.

By encouragement, medication and total abstinence the patient will soon regain his virility and confidence. Cold sponge

baths to the genital organs are often invigorating and beneficial if followed by a healthful reaction. Both mental and physical rest are necessary and a stay in a sanatorium or at a mountain or seaside resort may prove of value. The diet should be highly nutritious, and a little wine may be taken with the meals. The bowels must be carefully regulated, and the patient should have at least eight hours of sleep daily. The galvanic and faradic currents applied to the spinal column, penis and scrotum until a sharp tingling sensation is produced, except on the testicles, where a very weak current should be used, stimulate the circulation and nerves. These treatments are of value in psychical impotence and should be administered every two or three days, the strength of the current being determined by the sensibility of the patient.

Nervous impotence, with a hyperesthetic condition of the urethra, requires the passage of steel sounds about twice a week, allowing them to remain in the canal for about five minutes. Medium sized sounds should be used at the start and then gradually increased to 28 or 30 F. and Kollmann dilation when tolerance has been acquired.

Stimulating ointments and applications to the root of the penis, perineal region, and back are not without supplementary value in the treatment of impotence—especially the psychic variety. W. J. Robinson recommends the following prescription:

R	Camphorae .....	0.66 grs x
	Oleoresinae capsici .....	0.15 mii
	Olei sinapis .....	0.15 m ii
	Petrolati .....	8.00 3ii

M.

A small quantity (about the size of half a pea) is rubbed around the root of the penis at night. The persisting warmth tends to increase the sexual desire. The penis is to be washed



off the next morning with soap and water and dusted with talcum powder to avoid irritation.

This ointment may also be used as a local application to the skin over the lumbar and sacral regions, or strips of mustard plaster may be applied. Chloroform is also a useful remedy if painted on the back until there is considerable burning. The electric cautery at white heat quickly applied in strokes up and down the spine may be useful as well as dry cupping, massage and vibration.

The psychophore may also be used with advantage; by passing ice water through it, cold may be regulated and maintained as indicated. Hot water applied in this form has been suggested to strengthen erections as have cold urethral and bladder irrigations and cold sitz baths. Instillations of nitrate of silver in 1% to 2% aqueous solutions may be deposited in the deep urethra once or twice a week.

Where the urethra is so hyperesthetic that sounds and instruments cannot be passed readily, the canal should be partially distended with a lubricant containing cocaine, gum tragacanth, glycerin and water, as previously described, and the sound gently introduced as a piston to carry the preparation deeper and into the folds; after this, larger instruments or instillators may be passed with less pain.

Prostatic and vesicular massage may be administered once or twice a week if chronic inflammation exists or if the amount of secretion is excessive.

In the atonic impotence, sexual rest and a thorough course of tonic treatment should be insisted upon. Then, when the patient has regained his strength, strychnine, phosphorus, atropin or cantharides may be prescribed, but not for any length of time, nor before the period of one, two or even three months of total abstinence. Frequently the patient will be cured by the rest and general tonics and will not need any of these auxiliary

remedies. The general, dietetic, hygienic and electrical treatment given for psychical impotence is of equal value in the atonic form.

Paralytic impotence offers little hope of improvement by any form of treatment.

Sterility, or impotentia generandi, may be due either to defective semen or to pathological conditions of the sexual organs. The quantity of normal semen varies from four grammes (one drachm) to twenty grammes (five drachms.) By hydro-spermia is meant abnormal dilution of the semen. Pyospermia is semen containing pus, and is found in vesiculitis and prostaticitis; blood may also be present in the semen—hemospermia. Normal semen may be found, but malformation of the penis may prevent its being deposited within the vagina. Aspermatism is the term used to describe the condition where semen is formed, but is not advisable for impregnation on account of impotence, strictures and obliteration of the ejaculatory ducts. In azoospermia the semen is devoid of the power of fecundation, and may result from undescended or diseased testicles, from absence of both testicles (anorchism,) from occlusion of the epididymis or from certain general diseases.

#### THE VERUMONTANUM.

The verumontanum is a small projection situated on the floor of the deep urethra. It is composed of muscular and erectile tissue. The anterior portion contains a small cavity called the sinus pocularis in which organisms are at times likely to linger and cause recurrent infections. The verumontanum is very sensitive and bleeds easily. It often becomes hyperemic, hypersensitive and hypertrophied. Such lesions may cause urinary and sexual disturbances. Among the symptoms produced are frequent urination, an uncomfortable sensation at the neck of the bladder, burning at the end of urination, undue

sexual excitement, frequent emissions, involuntary emissions and sexual impotence. The sexual weakness is usually preceded by sexual hyperesthesia and premature emissions. Later the erections become weak, and, finally, total impotence results with mental depression and sexual neurasthenia.

Hypertrophy of the verumontanum is closely associated with and is probably caused by the growth of attenuated organisms in the prostate gland as previously described. Our conception of the etiology is that the toxins produced by these organisms pass into the deep urethra and by their continued action cause these pathologic changes of the verumontanum.

The treatment consists of local applications of a 5% solution of nitrate of silver through an endoscope once weekly, Kollmann dilation, and prostatic massage. An instillation of tincture of ratanae (Vecki), one minim, into the deep urethra every two or three days may be employed instead of the more valuable though more heroic treatment with nitrate of silver. The dilations of the deep urethra should be carried gradually to 40 or 45 F.

#### ENDOSCOPY.

There are various kinds of lights and endoscopic tubes for treating the verumontanum. Gentleness and skill are necessary requisities no matter what the variety of endoscope. We use the lamp devised by Squier, which reflects the light through the endoscope to the field being treated.

The patient voids his urine and lies upon his back with his knees slightly flexed and separated. The penis is washed and surrounded with sterile towels. The endoscope, previously boiled, is inserted beyond the external sphincter, but not into the bladder. With a little practice one learns the depth to pass the instrument, to bring the verumontanum into view. (Wooden applications carefully wrapped with cotton, placed in a test tube,

corked, and sterilized in an autoclave affords an easy method of providing sterile applicators.) The verumontanum is cleaned to remove the secretion and blood, then the nitrate of silver is applied.

Straight tubes often enable one to secure a better view, but cause more pain and hemorrhage than do those curved like a sound.

**GOLDSCHMIDT ENDOSCOPE.**—For diagnostic purposes the endoscopes devised by Goldschmidt and by Buerger, which dilate the urethra with a boric acid solution, give a better view and show pathologic conditions more clearly than do the endoscopes used for treatment. The instrument is inserted, the obturator removed, the telescope inserted, the irrigating outfit connected and the observations made. A splendid view of the deep urethra and internal sphincter is thus secured.

## INCONTINENCE OF URINE.

Enuresis, or bed wetting, may be nocturnal, diurnal, or both, and although it normally ceases at the age of two or three years, it may last until puberty, or a few years later. At night the urine is voided without waking the child; during the day the desire to urinate may be so urgent that the urine cannot be retained until the patient reaches a suitable place for emptying the bladder. It is usually found in weak, nervous, excitable children, and is more frequent with boys than with girls, but in adults it occurs more often in women than in men. It is often associated with adenoids and enlarged tonsils and is thought to be not infrequently an expression of a deficient secretion of the thyroid gland.

**ETIOLOGY.**—Enuresis is usually associated with some local irritative process involving the genito-urinary organs or rectum, as adherent prepuce, phimosis, balanitis, adherent clitoris, vagi-

nititis, cystitis, calculus, contracted bladder, anal fissure or pinworms. Heredity is often an important factor, and several in the same family may be affected. Highly acid or very alkaline urine may cause incontinence, especially if there is constitutional weakness, as malnutrition and anemia. Affections of the nervous system, which increase irritability of the spinal center or interfere with the cerebral control of urination, may produce enuresis. It is also frequently associated with hysteria and epilepsy.

THE PROGNOSIS.—The prognosis is better in young children than in older ones, for when the habit is firmly fixed much treatment will be necessary to overcome it, even after the local irritant that primarily caused the bed-wetting has been removed. The great majority can be cured, but months of treatment may be required, and the remedies should be continued several months after the incontinence has ceased.

TREATMENT should begin by removing the cause, if possible. The child should not be allowed much liquids after the middle of the afternoon, and the evening meal should be a light one. Any debilitating diseases should be carefully treated by medicines, fresh air, exercise, cold baths and massage. Whipping, scolding, or anything that increases nervousness should be studiously avoided. The bowels should be emptied late in the evening and the urine passed just before retiring. Belladonna, or its active principle, atropin, is the most important drug affecting the vesical sphincter, but must be administered in large doses and continued persistently. Tincture of belladonna may be given in two minim doses for a five-year-old child, and the dose gradually increased until the pupils begin to dilate, and after a week or two it may be diminished. Holt recommends a solution of atropin, one grain to two ounces of water, of which one drop may be given for each year of the

child's age. For nocturnal incontinence this dose should at first be given at 4 and 10 p. m., after a few days, at 4, to 7, and 10 p. m. Usually this may be increased until double the quantity is given.

Strychnia may also be administered in 1-100 grain doses, twice daily, and gradually increased to 1-50 of a grain. Thyroid extract in  $\frac{1}{2}$  to 1 grain doses three times daily may at times give a prompt result.

Other measures which may be tried as the child grows older, if this habit still persists, are cold douching of the perineum, the passage of a sound into the urethra, instillation of nitrate of silver into the deep urethra, and massage of the prostate and vesical neck through the rectum. Casper says he is convinced that to elevate the foot of the bed is also of value.

SUMMARY.—Very frequent nocturnal or diurnal emissions, sexual neurasthenia and sexual impotence are intimately and inseparably associated clinically. Successful management depends upon appropriate and simultaneous treatment for each. An important duty is to prevent the development of these disorders by lessening as much as possible the potent and far-reaching cause, namely, excessive masturbation; still another cause is uncured inflammatory lesions of the genito-urinary tract and stricture. Prolonged ungratified sexual desire with long continued congestion of the genital organs is a frequent cause. The treatment should always begin with a painstaking search for pathologic lesions as well as for other exciting or contributing causes. Good results will nearly always follow when some lesion can be found and cured. The sexual neurasthenic is often restored by a return of sexual vigor. The principal measures in the treatment are dilatation with the Kollmann dilator, massage of the prostate gland and seminal vesicles, local applications to the verumontanum, instillations of nitrate of

silver, hot or cold rectal douches, cold urethral and bladder irrigations, the psychophore, and electricity. The treatment should be varied according to the variety of the impotence.

HYPERTROPHY AND HYPERSENSITIVENESS OF THE VERUMONTANUM often cause urinary and sexual disorders. The treatment consists of endoscopic applications of nitrate of silver, Kollmann dilation, and prostatic massage.

INCONTINENCE OF URINE or bed-wetting often depends upon some irritative process involving the genito-urinary tract or rectum. The remedies should include treatment of the lesion found, and may be supplemented with atropin, thyroid extract, tonics, acids or alkalis and appropriate dietary and hygiene measures.

## CHAPTER XVIII

## DISEASES OF THE PENIS

PHIMOSIS, PARAPHIMOSIS, BALANITIS, HERPES, WARTS, CANCER.

## SUMMARY

**PHIMOSIS.**—This is a narrowing of the prepucial orifice so that the foreskin cannot be retracted behind the glans penis. Phimosiis may be temporary from inflammatory swelling, or permanent from congenital narrowing, cicatricial contraction or new growths.

Congenital phimosiis is present in most male children until about the sixth year, when a distinct enlargement of the prepucial orifice takes place. No special symptoms may arise from phimosiis unless there is obstruction to the flow of urine or inflammation under the foreskin. Adhesions may bind the prepuce to the gland and cause the retention of smegma. Many complications may be caused by phimosiis, as balanitis, fissures, venereal warts, subprepucial calculi, bed-wetting, hemorrhoids, prolapsus ani, hernia and dilation of the upper urinary organs. Sexual irritation, arrested development of the penis and convulsions sometimes are produced by phimosiis.

Acquired phimosiis may be merely a temporary swelling or congestion, or it may arise from a band of scar tissue following inflammatory lesions or trauma. The symptoms are few, but balanitis and balanoposthitis are not uncommon.

**TREATMENT.**—All venereal diseases are more likely to be contracted if phimosiis exists, and it is a factor of great importance in causing cancer of the penis; therefore, all male children should be circumcised about the eighth day. /At this early



age the operation is very slight, requiring no anesthesia and only 6 or 8 stitches. Temporary inflammatory phimosis should receive treatment according to the cause.

CIRCUMCISION should be insisted on in all permanent forms of phimosis. This simple operation has many modifications and variations, which will not be discussed. The parts should be well washed with soap and water, then with a 1-1000 solution of bichloride of mercury. Anesthesia may be obtained by injecting a weak solution of cocaine around the line in which the incision is to be made in the skin as well as in the quasi-mucous membrane back of the gland. If the cocaine is properly injected no pain need be caused by the operation. With a sharp scalpel an incision is made entirely around the penis in the mucous membrane about one-third of an inch back of the corona and a little farther back at the frenum. A foreskin clamp is applied over the foreskin at a point corresponding to the incision in the mucous membrane. After the clamp has been applied it should be removed and the skin allowed to retract in its normal position to determine if the proposed incision will be at the proper place. The marks left by the clamp afford an easy method of determining this. The clamp is again applied and the foreskin is incised close to the clamp. A collar of mucous membrane is left over the gland, this should be incised along its dorsal portion and then trimmed off to the first incision in the mucous membrane. If present, any irregular tags should be removed so that the line of apposition will be smooth. Bleeding vessels should be clamped and ligated with fine cat gut. The first stitch should be placed at the median raphe, the second exactly in the mid-dorsum, and then one on each side; others should be taken where needed to bring the margins well together and thus facilitate prompt healing. Either fine silk or cat gut may be used. The wound is dressed with bismuth subnitrate and liquid alboline, equal parts of each; this prevents sticking of the dressing,

and favors prompt healing; it is covered with cotton and a gauze bandage is applied so as not to interfere with urination or become too tight during the subsequent swelling and erections. Anaphrodesiacs may be given at night or an ice bag may be placed on the genitals to control the erections if severe. The dressing should be changed daily at first, if there is much oozing; and the stitches should be removed about the seventh day if silk is used. In infants a weak cocaine solution may be injected just as in adults, the clamp applied, the foreskin excised, the membrane trimmed away. Fewer stitches are required than in adults and should be of fine cat gut. The penis should be smeared with an ointment consisting of equal parts of bismuth subnitrate and lanolin or vaseline. A good size piece of sterile absorbent cotton is placed over the penis and the napkins applied to hold it on instead of a bandage. The dressing should be reapplied as the napkins are soiled.

If the incision is brought close together healing will be prompt. We disapprove of the irregular careless circumcisions often performed on babies, trusting to nature to absorb the tags and flaps.

**PARAPHIMOSIS.**—This term is used when the prepuce has been retracted behind the glans, and cannot be brought forward. It is likely to occur in all lesions of the penis, attended with swelling of the glans or foreskin, and especially if it has been forcibly retracted. The glans is decidedly enlarged, glossy and may be partially concealed by a swollen, edematous collar just in front of the constricting ring. Pain may be severe until the narrowing is relieved by ulceration or operation. In extreme cases the glans may become purple, non-sensitive and gangrenous.

**TREATMENT** consists in cocainizing the penis by injecting the tissue in the region of the dorsal nerve and then pressing

the glans back through the constriction. If this effort fails, a thin rubber band or gauze bandage should be wrapped around the glans and swollen part of the prepuce in front of the constricting band, so as to exert slight but steady pressure. This treatment, as a rule, so contracts the glans that it may be reduced. In case it fails, a curved bistoury should be passed from behind forward, with its blade flat, beneath the tense band, which is incised by turning the cutting edge up. One or more



Figure 57.—Herpes of the Glans. (White & Martin.)

incisions should be made, in order to allow easy and complete reduction. Wet dressings of a weak solution of ichthyol and diluted lead-water should be constantly applied until the swelling has subsided. If gonorrhea is the primary cause, mixed vaccines or phylacogen often act promptly in allaying the swelling after the paraphimosis has been reduced.

**BALANITIS AND BALANOPOSTHITIS.**—Balanitis is an inflammation of the surface of the glans penis; when the re-

flected portion of the prepuce is also affected it is called balanoposthitis.

ETIOLOGY.—The cause is usually a tight prepuce in connection with uncleanness, the collection of smegma, mechanical irritation or prolonged contact with irritating discharges.

SYMPTOMS.—The mild form begins with a slight itching and redness, succeeded by an exceedingly fetid discharge and excoriation. In neglected cases, large superficial ulcerations and edema develop.

DIAGNOSIS.—Balanitis should be differentiated from herpes, chancroid, gonorrhoea and chancre. Herpes begins as vesicles; these rupture and may be followed by balanitis or ulcerations. Chancroidal ulcerations are deeper, and are auto-inoculable. The chancre has a long period of incubation and is indurated. With gonorrhoea, a little care in the microscopic examination of the discharge and the urine, after washing the glans; will enable one to decide as to the source of the pus. Secondary syphilitic balanoposthitis may be recognized by the history, by the character of other lesions and by demonstrating the spirochaeta pallida.

THE TREATMENT consists mainly in cleanliness, the parts being washed with a 1-5000 solution of bichloride of mercury or a weak solution of subacetate of lead instead of soap and water. After washing and drying the inflamed surfaces, they should be dusted with a powder composed of equal parts of calomel, bismuth subnitrate and stearate of zinc. An even more comfortable dressing consists of equal parts of bismuth subnitrate and liquid albolene. The dressing should be changed from three to six times daily, according to the amount of the discharge. If the prepuce cannot be retracted, it should be washed out every two or three hours with tepid salt solution, by

means of a syringe with a long, flat nozzle, after which a 10% solution of argyrol should be injected under the prepuce and held for five or ten minutes. The soothing and healing effect of this solution is sometimes quite remarkable. In chronic balanitis, circumcision should be performed.

**HERPES PROGENITALIS.**—This is an affection of the skin and mucous surfaces of the penis, characterized by the sudden appearance of groups of vesicles with inflamed bases, attended with slight tingling and burning and a mild balanoposthitis. Neuralgic herpes is a rarer form accompanied by severe pain, much like that of herpes zoster.

**THE DIAGNOSIS.**—The lesions begin as a group of vesicles, which always precede the ulceration. Herpes is very rarely complicated by a suppurating bubo unless a secondary infection with ordinary pyogenic organisms follow. Such a lesion affords a favorable site for specific infection in case the patient should indulge in intercourse.

**TREATMENT** is practically the same as for balanitis. The pain may be relieved by local application of cocaine, or, if this fails, by the high-frequency current.

**VEGETATIONS, VENEREAL WARTS, VERRUCAE, OR PAPILLOMATA.**—These are mere papillary overgrowths, and may occur in almost any shape, size, or number, and may be either dry or moist. A redundant or phimotic prepuce is usually a predisposing factor, in that it provides moisture, warmth and irritating discharge, which cause them to develop. They may occur in great numbers around the vulva.

**TREATMENT.**—Cleanliness alone may cause the vegetations to shrink and disappear. When moist they may be anesthetized by applying a 5% solution of cocaine on cotton for a few mo-

ments, and then touched with pure nitric acid. They will not usually return after this procedure, if the predisposing causes are removed. When large or dry and on the skin surface, they should be clipped off with scissors and the base touched with pure carbolic acid or the actual cautery. Chromic acid, in 15% solution, is a useful remedy, but is dangerous when used over a large area. For warts on the skin, caustic potash, as in the following formula recommended by White & Martin, may be used:

R	Plumbi oxidi -----	.13	gr. ii
	Potass. hydrat. -----	1.3	gr. xx
	Aquae q.s. ad. -----	30.	ʒi

M. Sig.: Shake well and apply, by means of a brush, to the wart after it has been cleansed and dried. One or two applications are sufficient.

The importance of removing warts and redundant, phimotic foreskins in elderly men cannot be urged too strongly, because nearly all cancers of the penis arise from such conditions when neglected.

## CANCER OF THE PENIS.

Epithelima is practically the only type of malignant growth that attacks the penis. Barney reported the history and results of one hundred cases, mostly from the Massachusetts General Hospital. He found that cancer of the penis occurred usually between the sixth and seventh decades of life. Phimosis was pre-eminently the most important of the exciting causes, occurring in 85% of his cases. Syphilis, trauma, chronic balanoposthitis, ulcerations or any source of local irritation may act as predisposing factors.

SYMPTOMS AND DIAGNOSIS.—There are two types of growth, the cauliflower or proliferating, and the ulcerating, indurating edges and rapidly destructive properties.

oma usually begins as a flat, excoriated surface or as a small, warty growth. A slightly indurated base may exist from the beginning. If it is irritated, or the scab is removed, a little

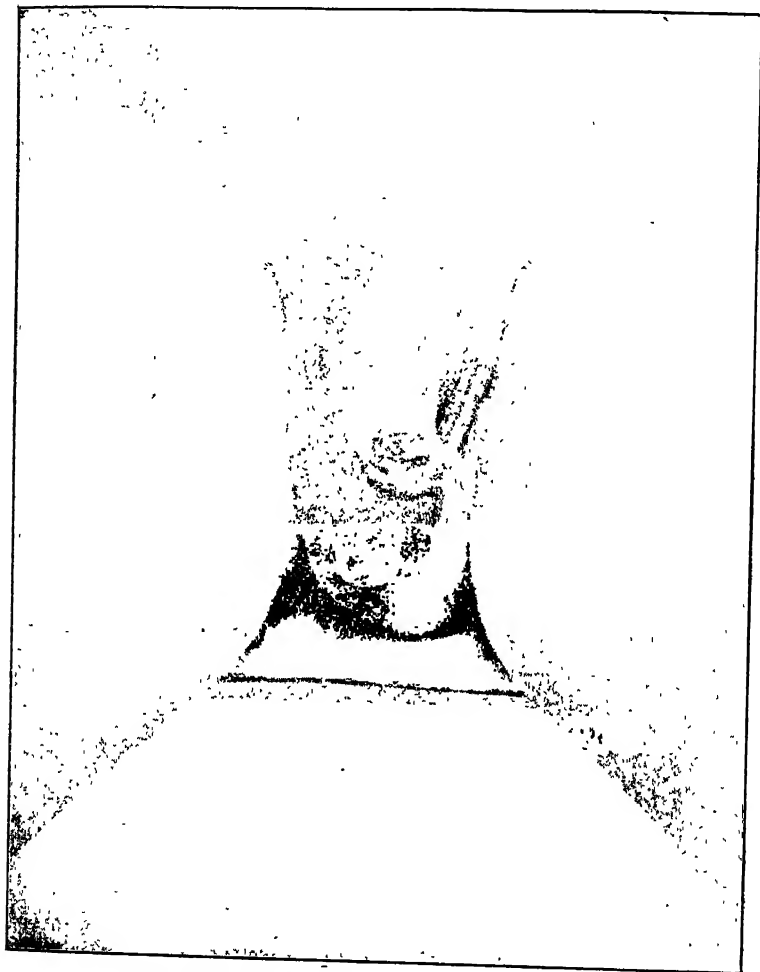


Figure 58.—Fungating Carcinoma of the Penis.

bleeding occurs and a larger dark-colored scab forms, which when finally removed will disclose an ulcerated surface beneath. The ulcer may be deep, irregular and unhealthy, with a fetid dis-

re, or it may first become exuberant, before the ulceration  
s. The cancer extends along the dorsum of the penis with  
main lymphatic vessels, involves the inguinal glands, and  
y a distant organ may be attacked. The patient's general  
1 fails, and emaciation and anemia become marked.

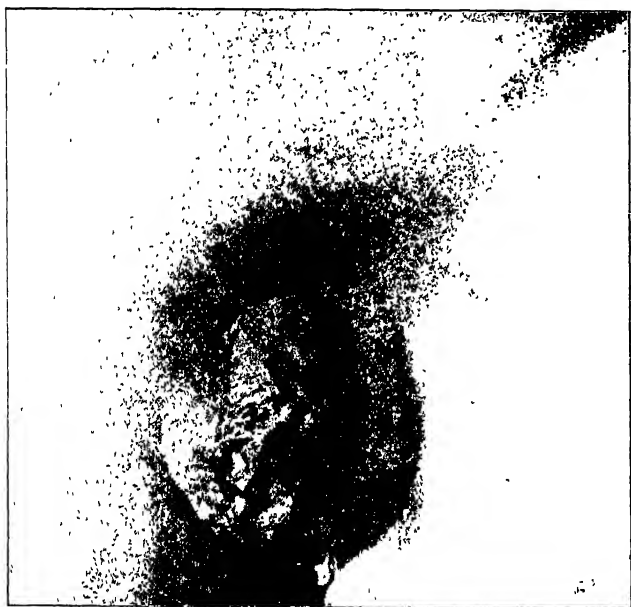


Figure 59.—Epithelioma. Ulcerating Form.

Keyes says that all warty growths, especially if they are  
much elevated and occur upon individuals past middle  
whose habits seem to be cleanly, and above all, if there is  
a shade of hardness around the base of the growth, should  
be regarded with suspicion, and their progress diligently  
watched. When ulceration commences, doubt should be laid  
aside and active measures resorted to at once.

**PROGNOSIS.**—Barney reported an operative mortality of  
gross mortality of 32%, and cures in 38%. If the cancer



is of considerable size the chance of a cure depends entirely upon the possibility of its removal with all connecting lymphatic glands. If taken early amputation alone will effect a cure. Sexual power is not necessarily lost on account of this operation.



Figure 60.—Epithelioma, Vegetating Form. (White & Martin.)

**TREATMENT.**—Partial removal may be used as a palliative measure, and is performed as follows: A large acupuncture needle is thrust through the corpora cavernosa, from side to side, well back of the tumor, to prevent the retraction of the stump. A rubber band or small rubber tube is tightly tied around the penis behind the needle to prevent hemorrhage. The skin and corpora cavernosa are divided at the proposed site of the operation, and the corpora spongiosa dissected loose for half an inch farther forward, before cutting off the urethra.

The ligature is now removed, but the needle is not withdrawn until the bleeding vessels are ligated. The fibrous sheaths are brought together and sutured over the ends of the cavernous bodies. The floor of the urethra is split back to the main stump, and sutured to the skin. A catheter is left in the bladder for three or four days. The wound is dressed with iodoform gauze and cotton, held in place with a Peterkin scrotal bandage.

The inguinal glands should be removed if they are diseased and all other cancerous tissue can be removed. Excessive edema of the scrotum, however, is likely to follow such operations.

The complete operation requires a large incision in the median raphe of the scrotum; the urethra is cut across at the bulb, and its deep end detached from the penis as far back as the triangular ligament. The suspensory ligament is divided, and the penis is separated from its deep attachments. A stout periosteal elevator is used to detach it from the pubic arch. The two arteries of the corpora cavernosa, the dorsal arteries and other bleeding points should be ligated. The urethra is split back for half inch and sutured to the back part of the incision in the scrotum. The wound is closed and drained; a catheter is retained in the urethra and connected to a tube for carrying away the urine. Plenty of sterile dressings and a scrotal bandage complete the operation, unless the inguinal glands are to be removed, in which case they should be carefully dissected and the wounds closed and dressed, according to the usual surgical rules.

**SUMMARY.**—Phimosis is a narrowing of the prepuceal orifice and may be congenital or acquired. It should be treated by circumcision. No tags or flaps should be left by this operation. The best dressing is equal parts of bismuth subnitrate and liquid albolene. The latter being taken up largely in the cotton or gauze dressing leaves an almost dry layer of bis-

muth on the surface and greatly facilitates the removal of the dressing and at the same time the wound is not mascerated as by the use of ordinary ointments. Paraphimosis is the term used to describe the condition when the foreskin has been retracted behind the glans penis and cannot be brought forward. Cold applications and pressure usually cause its reduction. If not, the constricting band should be incised. Balanitis is inflammation of the glans penis. Balanoposthitis is an inflammation of the reflected portion of the prepuce. The treatment comprises cleanliness, injections of 10% argyrol, which should be retained ten minutes or longer, and by injections or application of bismuth and liquid albolene. Herpes progeneralis develops as recurrent groups of vesicles irrespective of coitus. Unless infected they soon pass away but show a great tendency to return. Venereal warts may be of the moist or dry variety, the former usually being caused by the moisture and irritation of a redundant prepuce; they may be removed by carefully applying nitric acid after previous cocainization. Dry warts should be clipped off with the scissors and their bases touched with a saturated solution of nitrate of silver in concentrated carbolic acid, or a cautery. Cancer of the penis is nearly always associated with the irritation of phimosis and warty growths; such growths in individuals past middle life should receive the closest observation, and if ulceration begins, operative measures should at once be resorted to. Prophylactic circumcision and early excision of the growth after it develops are the two main points to remember in connection with cancer of the penis.

## CHAPTER XIX

## CHANCROID

INCUBATION AND COURSE, CLASSIFICATION, DIAGNOSIS, COMPLICATIONS, ADENITIS, DIAGNOSIS OF BUBOES, TREATMENT OF CHANCROIDS, TREATMENT OF ADENITIS, SUMMARY.

CHANCROID is a local venereal ulcer, secreting a virulent autoinoculable pus, but it is never followed by constitutional symptoms. It was formerly thought to be identical with syphilis, and we are indebted to Bassereau for demonstrating their duality. Chancroid is carried by the inoculation of an abraded surface with the secretion of a chancroidal lesion, or by contact of this secretion with even healthy skin or mucous membrane. There seems to be little doubt that the disease is caused by a germ of some kind—probably the Ducrey-Unna steptobacillus, which is described as a short, thick organism, about 1.5 m. in length and 0.6 m. in width, with rounded ends and a central constriction. A number of careful observers have been able to demonstrate this bacillus in the secretion from the chancroid of apes. Lydston and Taylor believe that simple ulcers may be transformed, by filth and neglect, into true chancroids; nearly always, however, chancroid is contracted during sexual intercourse. Secondary inoculations may take place on adjacent or opposed surfaces, and occasionally more remotely if the secretion be deposited upon a abraded surface. The usual pyogenic organisms may be found in the secretion from the chancroid. The lower classes of society are more likely to be infected with the disease than are those in better circumstances.

INCUBATION AND COURSE.—The average period of incubation is from four to eight days, but it may be shortened if the

germs be implanted upon a surface considerably abraded by traumatism, or herpes, or a pre-existing fissure. The lesion begins as a patch of hyperemia, a papule or pustule forms, which, as a rule, is not observed until the stage of ulceration. The chancroid is usually round or oval in shape, with punched out, irregular, undermined edges. The base is rough and is covered with a gray or yellow exudate. The ulcer bleeds easily and is tender and painful. The secretion is profuse and purulent, and when inoculated upon the surrounding surface other chancroids may follow, while with the chancre the reverse is true. When multiple, chancres occur coincidentally or very soon after the initial lesion appears. Unless carefully treated, chancroids are nearly always multiple. The chancroid is usually on the genitals; its favorite seat is on each side of the frenum, and it is when situated here that buboes are most likely to result. Any part of the penis, scrotum, pubic region, vulva or thighs may be affected. The lesion is surrounded by a reddish, inflammatory area, but has not the hard induration characteristic of a chancre. It spreads along the surface by a process of ulceration, and produces an irregular outline by progressing more rapidly in some directions than in others. Healthy granulations begin in from one to four weeks, and then the chancroid rapidly heals, but it may, if neglected, be transformed into a chronic, simple or infectious ulcer of indefinite duration.

CLASSIFICATION.—Aronstam has given the following comprehensive classification of the various ulcerations which may be found on the male genitalia. While many of them are rare, it is well to bear in mind their possibility when the diagnosis is involved in doubt.

1. The neurophatic or herpetic ulcer (or toxic.)
2. The gonococcic ulcer (occasionally found during gonorrhea in uncleanly individuals who have long foreskins).
3. The infecting ulcer or chancroid.

4. The initial sclerema or chancre.
5. The simple or idiopathic ulcer.
6. The leprotic ulcer.
7. Ulcerations due to errors of metabolism and the different dyscrasiæ.
  - (a) The ulcers of nephritides.
  - (b) Those due to the uricemic state.
  - (c) Scorbutic ulcerations.
  - (d) Ulcers accompanying hemophilia.
  - (e) Ulcers caused by diabetes.
  - (f) Hemopoietic or trophic ulcers.
8. The malignant ulcer or epithelioma.
9. The tubercular ulcer and lupoma.
10. Atypical, obscure and unclassifiable ulcerations.
11. Erosions and ulcers due to eczema, lichen, psoriasis, ecthyma, blastomycetes, and various other parasitic dermatoses.
12. Ulcers resulting from papillomata and other forms of vegetations.
13. Ulcerations following in the course of endarteritis obliterans of the extremities.

The more severe forms of chancroid are due to neglect, lack of vitality and secondary infections.

Gangrenous chancroids have a black base and spread rapidly and deeply. This may cause much loss of tissue, and leave permanent deformity from destructive necrosis.

The phagedenic form is more destructive than the simple chancroid and is usually due to complications, as phimosis or paraphimosis. The pain is decided, and the discharge profuse and perhaps, sanious. It is really a rapid ulceration by a very active secondary infection.

Serpiginous chancroid is characterized by a tendency to spread by slow ulceration, one part healing while another becomes involved; this is a rare form, as is also the diphtheritic,

which is covered with a membrane of brownish or yellow color, but does not extend deeply. Vegetations may occasionally appear in chronic persisting chancreoids. Syphilis may also be implanted along with the chancroidal virus and a typical chancre may follow healing of the chancroid.



Figure 61.—Multiple Chancreoids. (Fox.)

DIAGNOSIS.—The most important point in the diagnosis is to differentiate the chancroid from chancre, and since the discovery of the *spirochaeta pallida*, the germ that is now believed to be the cause of syphilis, we approach this subject with

more confidence—particularly when our findings are positive. The methods for staining for this organism are described in the section on syphilis.

There are many points in the course and history of chancroids which enable us in most cases to reach a correct diagnosis, but the fact that syphilis may be implanted with the chancroidal virus must never be lost sight of no matter how typical the lesion. Chancroid usually appears within a week after exposure, while chancre does not occur for ten to twenty-one days or longer. Chancroids commence as pustules or ulcers, are usually multiple, irregular, punched out, with precipitous or undermined edges and a worm-eaten looking floor. The secretion is profuse and auto-inoculable. There is no hard, well-defined induration unless it has been cauterized. Lymphangitis and adenitis may be present; the buboes are inflammatory, large, tender and frequently suppurate. Chancre begins as papule or scaly indurated patch; ulceration usually follows. Chancre is generally single, or multiple from the start or soon after the initial lesion appeared; chancre is not auto-inoculable when well established. The erosion is saucer-shaped and superficial, with sloping, flat or rounded edges, and a clean looking floor. The secretion is scanty and serous, the induration is firm and hard and extends for some distance beyond the edge of the erosion, and has a well-defined margin. There may be very little loss of tissue, which is in marked contrast to the destructive action of the chancroid. The inguinal glands are enlarged in a chain on each side, are non-inflammatory and painless. The demonstration of the *treponema pallida* will dispel all doubt. Chancroid can be differentiated from an ulcerating gumma or mucous patch by the history and course of the lesion. The same may be said of herpes progenitalis, which, beginning as small vesicles, later becomes pustules. They may erode and coalesce, forming a large ulcer if neglected. "Hair cuts" and balanoposthitis



do not, as a rule, produce ulcerations under appropriate treatment.

COMPLICATIONS.—Inguinal adenitis, or bubo, is an inflammation of the lymphatic glands, which may or may not suppurate. Those due to chancroid are more likely to progress to pus formation than gonorrhoeal buboes, while syphilitic glandular enlargements rarely suppurate. Buboes are caused by the passage of the virus up the lymphatic channels to the glands, which act more or less as filters, and prevent the passage of germs or toxins into the general circulation. Infective lesions on the lower limbs may cause adenitis, but then femoral, not inguinal, glands are involved. Buboes may be caused by a simple ulcer of the penis, chancre, chancroid, herpes and balanitis. A bubo begins as a slight enlargement of an inguinal gland which becomes sensitive to touch and causes considerable pain on walking. Unless aborted at this stage it grows larger and more tender, and in one-third to one-half of the cases suppurates. There may be slight constitutional symptoms, as fever, chills, etc. The condition tends to become chronic in debilitated or tuberculous patients. Peri-glandular induration may occlude the lymphatic channels and produce edema of the penis. Burrowing pus may leave sinuses which may persist for a considerable time. Phagedena, gangrene and erysipelas may occur. Virulent buboes are those with much peri-glandular infiltration and a rapid formation of pus. The pus in such cases may be auto-inoculable, and after rupture the abscess cavity may assume the characteristics of a chancroid. From a study of 543 soft chancres, Ivanyi reported that about 45% had buboes.

DIAGNOSIS OF BUBOES.—Simple inflammatory adenitis may result from chancroid, chancre secondarily infected with pyogenic organisms, gonorrhoea, balanitis or a simple ulcer of the penis. Buboes may arise at times when very mild infec-

tions are present, or, occasionally, when no cause can be found. The most constant finding in these apparently idiopathic buboes is the microscopical picture previously described under prostatitis, where myriads of attenuated organisms are found in a small amount of prostatic secretion. Usually associated with this infection is the history of some straining effort or traumatism. Virulent buboes may become phagedenic or gangrenous and secrete an auto-inoculable pus. They are painful and suppurate in spite of treatment. Syphilitic buboes are usually small, hard and painless and do not suppurate, unless the chancre becomes infected or there is a decided lack of resistance on the part of the patient. The chancroidal bubo generally occurs on the same side as the lesion of the penis, is large, irregular and inflamed, while those caused by syphilis affect both sides, are small, multiple, smooth and hard.

**TREATMENT OF CHANCROID AND BUBO.**—Circumcision and cleanliness are the chief prophylactic measures to be insisted upon. After removal of the prepuce, the glans penis and quasmucous membrane of the remaining foreskin become hardened, and are less likely to be eroded and infected, and the important post-coital ablution may be more thoroughly performed.

When seen early and positively diagnosed, the chancroid should be cauterized and thus transformed into a single sore by the destruction of the infecting organism. But this treatment should never be undertaken unless it can be thoroughly done, otherwise the condition will be aggravated, and the lesion rapidly changed into a large and more active sore. The electric cautery and nitric acid are the most valuable cauterants, but it is needless to say that both should be cautiously applied. The penis should be cleansed well with soap and water, then with 1-2000 bichloride of mercury. Cocainization is necessary, and can best be obtained by injecting about 5i of  $\frac{1}{4}\%$  to  $\frac{1}{2}\%$  of cocaine into the tissues surrounding the dorsal nerve close back

against the symphysis pubis; or, if preferred, a crystal or tablet of cocaine may be placed directly upon the ulcer and left there about five minutes. The chancroid is then dried and burned with the electric cauterium heated to white heat, or nitric acid may be applied on a toothpick around which a very small piece of absorbent cotton has been tightly wrapped; this is preferable to the glass rod, for the drop of acid on the end of the rod cannot be controlled. The entire ulcer with all undermined edges should be thoroughly cauterized. A powder of calomel, 1 part, and subnitrate of bismuth, 4 parts, should then be dusted upon the wound. An effort should be made to keep the scab dry and to prevent its becoming detached for a day or two; then, when it scales off of its own accord, a clean, healthy surface is left, which promptly heals if all the organisms were destroyed as it is changed into a simple sore. The parts should not be washed until the coagulated membrane over the sore has come away. Chancroids involving the meatus should not be cauterized, nor should those complicated with a painful bubo, nor those with a healthy granulating surface, nor those when the entire chancroid cannot be reached. Silver nitrate should never be used, as it is followed too great inflammatory reaction. This remedy is only indicated in indolent ulcers where the granulations need stimulation. Carbolic acid may be applied just before cauterizing with nitric acid, to lessen the pain. If the chancroids be too extensive for such treatment, a continuous bath in hot solution of bichloride of mercury should be given, 1-10000.

Iodoform is generally conceded to be the best local dry dusting powder, but it has the disadvantage of a 'tell-tale' odor, which may be controlled by mixing one part of it with equal parts of balsam peru and lanolin. This lessens the odor and combines it with our next best remedy, balsam peru. The lanolin is added to dilute the latter remedy and prevent its irritation so that it may be applied 4 to 8 times daily. Cocaine

may be added when needed to control the pain. Acetanilid is also useful in relieving the pain. A powder composed of bismuth subnitrate, 1 part, calomel, 1 part, and stearate of zinc, 2 parts, is a satisfactory combination for simple ulcers. For urethral chancroids, Casper recommends iodoform applied in a cocoa butter bougie. When phimosis is a complication the sub-prepuceal space should be frequently washed out with an injection of argyrol, 10%, or a weak solution of carbolic acid or potassium permanganate. If more active treatment is required, a dorsal incision should be made in the foreskin and free access to the ulcers provided. Circumcision should not be attempted, as infection is likely to take place in the flaps. In case of paraphimosis, if the swollen part cannot be reduced, the constricting band should be incised.

When there is danger of phagedena or gangrene, in addition to active local measures, constitutional treatment is of much importance, and the free administration of tonics is indicated. The value of cleanliness in the treatment of chancroids cannot be overestimated.

THE TREATMENT OF ADENITIS depends upon the stage; if treated from the beginning pus formation may at times be avoided by rest in bed, painting the inguinal region with tincture of iodine, and in addition the application of the ice bag. If the patient insists upon remaining up and attending to his duties equal parts of ichthyol, lanolin and belladonna ointment should be smeared over the bubo and then covered with plenty of cotton, held in place with a spica bandage, snugly applied. This should be re-applied once daily. Hot flaxseed poultices are also of value. After the formation of pus a small incision should be made over the soft area, and the contents of the bubo evacuated by pressure around the swollen gland. An endermic and hypodermic injection of 2% solution of cocaine or Schleich solution will enable the surgeon to make the opening into the bub

without pain. An ointment of ichthyol, lanoline and vaseline, equal parts of each, should then be applied and covered with sterile gauze and cotton dressings, held in place with a spica bandage. The bubo should be dressed daily. Later, if the tract is slow to heal, bismuth subnitrate suspended in liquid alboline should be injected once daily. Glycerine injections into indolent cavities cause the exudation of serum and hastens the cure.

In case a bubo remains hard for some time without pus formation, counter irritation and pressure should be instituted and citric acid, 2.0 (30 grs.) three times daily, should be administered for a few days. Buboes infected with the chancroidal virus should be kept clean, dusted with iodoform once or twice daily, and the dressings frequently changed. Iodoform placed on an extensive area may occasionally be absorbed in sufficient quantity to cause poisoning.

If a bubo becomes phagadenic or gangrenous, thorough cauterization under an anesthetic should be done.

Owing to the fact that persistent swelling of the leg may follow excision of buboes, we do not recommend this procedure even though the bubo runs a chronic course. Vaccine therapy and phylacogen afford great assistance at times.

SUMMARY.—Chancroid is a contagious auto-inoculable venereal ulcer which is never followed by constitutional symptoms as is chancre. It is caused by the Ducrey-Unna streptobacillus. Filth and neglect favor its development and extension. The incubation period varies from three to eight days. It is a punched out, irregular sore, with undermined edges and has dirty grayish or yellowish base. The secretion is profuse and urulent. Opposing surfaces often becomes inoculated. This rarely occurs in chancres; if they are multiple they become so as a rule within ten days or earlier unless mixed infection is present. Chancroids are usually multiple. Chancroids have

not the well defined induration so characteristic of chancre. The enlargement of the inguinal glands in chancroid is inflammatory, large and tender, and they frequently suppurate. The chancre has sloping, not undermined edges, its base is cleaner looking, the secretion is less abundant and contains less pus. There is very little loss of tissue. The inguinal glands are enlarged in a non-inflammatory chain on each side and rarely suppurate. The *spirocheeta pallida* may be demonstrated in the secretion with dark field illumination or by stains. Herpes, simple ulcers, and balanitis may be differentiated by the character and history of the lesions. Bubo is a frequent complication of chancroid though it may arise from any infection of the penis and urethra. It begins as a slight enlargement of the inguinal glands which may increase in size and undergo resolution or suppurate.

The treatment of chancroid depends upon the stage and site of the sore. If seen early and is not situated around the meatus it should be thoroughly cauterized with carbolic and nitric acid or with the electric cautery. If too extensive for this treatment there seems to be nothing so useful as iodoform; its odor may be controlled by mixing it with balsam peru, which also, is a useful remedy for chancroid. After the use of this iodoform-peru ointment for a few days it should be alternated with a dry powder frequently applied. Cleanliness is of great importance. The next best treatment is constant washing and the application of bismuth subnitrate, calomel and stearate of zinc, equal parts of each, six to ten times daily. Buboec require rest and the ice bag, later ichthyol, hot poultices and an incision if pus forms.

## CHAPTER XX

## DISEASES OF THE TESTICLES, SCROTUM AND CORD

ORCHITIS, TUBERCULOSIS AND TUMORS OF THE TESTICLES,  
HYDROCELE, CONGENITAL HYDROCELE, VARICOCELE,  
SUMMARY

DISEASES OF THE TESTICLES.—The testicles are loosely suspended, by the spermatic cord, in the scrotum, the left being a little larger and hanging slightly lower than the right. They weigh about six drachms and are covered by the tunica vaginalis and the tunica albuginea, the former being a closed serous sac, while the latter is a dense, white, fibrous membrane which invests the secreting portion of the testicle. The epididymis covers the top and back of the testicle; the upper part of the epididymis is known as the globus major or head and the lower portion as the globus minor.

The testicle is sometimes arrested in its descent from the abdominal cavity; this is particularly likely to occur during its passage through the inguinal canal. Such failure of both the testicles to descend into the scrotum is called cryptorchidism. If one testicle only is present in the scrotum the condition is known as monorchidism. As a rule, undescended testicles are undeveloped, and when both have failed to descend, the individual is sterile but not impotent, the normal sexual desire being present. The retained testicle is likely to be painful and may become the seat of malignant disease.

ORCHITIS.—Orchitis is an inflammation of the testicle; this is very frequently along with epididymitis, but true uncomplicated orchitis is very uncommon.

ETIOLOGY.—The chief causes are parotitis and severe injury to the testicle; others are cold, typhoid fever, excessive sexual excitement, malaria, gout, tonsillitis, smallpox and scarlet fever.

SYMPTOMS.—There is a slow or, if caused by trauma, a rapidly growing tumor with great pain which is out of proportion to the size of the swelling. The pain is peculiarly “sicken- ing” in character and its sudden cessation may mean destruction of the parenchyma of the testicle.

PROGNOSIS.—When there is a true orchitis it is likely to be followed by atrophy.

THE TREATMENT of orchitis should consist of but one thing and that is incision of the tunica albuginea before the testicular structure has been so damaged that the usual atrophy follows. From a considerable study and from many inquiries, we are convinced that the general practitioner who treats these conditions, rather than the genito-urinary specialist, could save many from atrophy by a prompt incision. This would prevent the pressure and lessen the toxins which later cause the atrophy. Mumps seem more likely to produce atrophy of the testicle than do other affections which cause orchitis. The operation is very simple and may be performed under gas much as epididymo- my previously described. If this procerure is not thought expedient the conventional treatment which causes so many testicles to atrophy may be used: The patient is placed in bed, the testicles elevated and painted with equal parts of ichthyol and olive oil, or 20% to 30% solution of guaiacol in glycerin. An ice lag or hot poultices may also be used. The bowels should be kept open and morphine given hypodermically to relieve the pain. A close fitting suspensory should be applied as soon as acute inflammatory symptoms have subsided, and worn fo



months. Very rarely an abscess may develop, with fever and edematous swelling of the scrotum.

Fungus or hernia of the testicle may follow suppuration, gangrene, syphilis or tuberculosis; and appears as an irregular mass protruding through an opening in the scrotum.

**TUBERCULOSIS OF THE TESTICLE.**—This disease may result from the entrance of the germs from the general circulation (miliary tuberculosis), or the tubercle bacillus may extend to the testicle from tuberculosis of the prostate, seminal vesicles, bladder or kidneys. The epididymis is thought to be a frequent seat of primary tuberculosis. Infiltration is, as a rule, first noted in the head of the epididymis. The tubercle finally undergoes a cheesy degeneration. The same thing occurs when the disease begins in the testicle.

**SYMPTOMS.**—The symptoms, when of sudden development, are much like those which arise from the gonorrhoeal epididymo-orchitis, though instead of subsiding, they persist. The pain, however, ceases, and finally the swelling undergoes degeneration, ruptures, and may form one or more sinues. The organs on both sides may be diseased. It occurs most frequently in young adults. There is an insidious form which begins in the testicle or epididymis as painless nodules, which slowly increase in size without any symptoms except, perhaps, a sense of dragging or sexual hyperesthesia.

**DIAGNOSIS.**—The diagnosis of acute tubercular epididymo-orchitis is based largely on excluding all other possible causes of inflammation or enlargement, and upon evidence of tuberculosis in other of the genito-urinary organs or elsewhere. Persistence of swelling after the acute inflammation has subsided and the formation of nodules, which finally break down and leave fistulae, from which tubercle bacilli may be obtained, re-

move all doubt as to the diagnosis. The chronic form may be recognized by the painless, non-inflammatory nodules, usually in the head of the epididymis, in a patient with a tubercular history, and perhaps no history of gonorrhoea. Tubercle bacilli, pus and blood in the urine prove the diagnosis. A thorough examination of the pelvic organs and the kidneys should be made. Tuberculosis may follow a gonorrhoea, and the presence of gonococci need not exclude tuberculosis.

PROGNOSIS depends upon the extent and rapidity or development of the disease as well as the involvement of other organs. Sometimes a focus of infection may become encapsulated and remain quiescent for a while, but this may become active at a future time. The prognosis is good when the disease is limited to the epididymis, or testicle, if it responds to small doses of turberculin or if it is promptly extirpated.

TREATMENT.—A nourishing diet, appropriate hygiene, and life in the open air, in a good climate, effect about as much improvement in this condition as in other forms of tuberculosis. Iodide of iron, quinine, cod liver oil, and tonics should be given. A snugly fitting suspensory should be worn to protect and support the testicles.

Operative treatment has a limited field of usefulness if the disease is secondary to infection elsewhere. When the lesion is strictly localized, it may be excised and the wound packed with iodoform gauze. If this and other treatment fail, castration may be performed. White and Martin claim excellent results from the use of 10% iodoform emulsion in glycerin (5 to 15 drops at a dose) injected directly into the infiltrated mass. The needle is introduced at several points and two or three drops are deposited at each point.

SYPHILIS OF THE TESTICLE.—The description of this condition will be found under the head of visceral syphilis.

**TUMORS OF THE TESTICLE.**—These tumors are either malignant or benign. The malignant are usually carcinomata and sarcomata; while those generally considered benign are the fibromata, adenomata, etc. Russess Howard thinks that all new growths of the testis should be looked upon as malignant, in spite of the fact that the enlargement may have been present for years without the occurrence of secondary deposits, as the clinical history and physical signs give little or no information as to the type of the growth present. He says furthermore: "Since the pathologist cannot agree, there is little use in a clinician labeling tumors, carcinomata or sarcomata." His study of 57 cases of malignant disease of the testis showed the average age of its occurrence to be 32, five being in children before the age of 12. Cancer is undoubtedly more common in the undescended than in the descended testis.

**ETIOLOGY.**—The etiology is, of course, unknown. Traumatism has been thought by some observers to be a causative factor. We believe previous epididymitis and adhesions between the testicle is a predisposing cause.

**SYMPTOMS.**—The enlargement of the organ is the first symptom; another may be the dragging pain in the groins, but this is never very severe until the tumor has reached considerable size. A hydrocele or hematocele may exist and add to the confusion. Localized bulgings in the tunica albuginea may give the tumor a nodular appearance; this is especially true of the fibrocystic testicles. The scrotal veins are nearly always dilated. The epididymis is very rarely involved primarily, but it is so stretched over the tumor that it may be impossible to recognize it clinically. The presence of the testicular sensation depends upon the amount of normal tissue left in the testicle; this sensation is frequently lost early. The cord and vas are usually unaffected. The scrotum, although normal at first, finally becomes

adherent at some point from which the tumor may fungate. The lumbar glands are first affected and may cause considerable enlargement. Cachexia, loss of weight and loss of strength develop as in other cancers.

**DIAGNOSIS.**—Early diagnosis is very important as a late operation offers very little hope. In making a differential diagnosis the following diseases must be considered: Hematocele, hydrocele, syphilitic orchitis and tuberculosis.

Hematocele is frequently confused with the malignant growth of the testicle. Here the history is of value; the swelling comes suddenly a few hours after an injury; it increases in size intermittently; pain is an early symptom, and the surface of the enlargement has not the irregularity that is found in cancer. Where much doubt exists it should be settled by an exploratory incision.

Hydrocele, with thickened fibro-cartilaginous or calcareous walls, may be mistaken for a malignant growth. This, too, requires an exploratory incision for an accurate diagnosis—not tapping, for the trocar may enter a cystic tumor and give a misleading serous or mucoid fluid.

In syphilitic orchitis the enlargement is not so great, the epididymis is more readily distinguished; there is a history of syphilis and active antisymphilitic treatment will cause a prompt diminution in the size of the tumor.

Tuberculous testes do not grow to a great size; the cord and vesicles are likely to be involved; there is no enlargement of the scrotal veins; it begins usually in the head of the epididymis, and it is very rebellious to treatment. The testicles are irregular and hard and no glandular metastases occur. Although there is a tendency to suppurate and leave fistulae, tuberculous testes do not often form fungating growths.

**PROGNOSIS.**—The prognosis depends largely upon the prompt removal of the growth; this should be done even if the glands are enlarged, for it removes a disagreeable tumor and prevents a fungus formation. Of Howard's 57 cases no patient, so far as could be ascertained, lived longer than a year after the involvement of the glands, and in the majority, death ensued much earlier, but in only three cases was there a local recurrence.

**TREATMENT.**—Malignant tumors should always be removed even if the glands are affected, for the operation is not very dangerous and rids the patient of a source of great inconvenience. An operation is contra-indicated in advanced conditions with large lumbar swelling or secondary infection of other organs, or if the cord is infiltrated, for this will render the control of hemorrhage difficult, the growth will fungate through the wound.

**CASTRATION.**—The scrotum, perineum and pubes should be shaved and thoroughly scrubbed, and an incision made into the anterior part of the scrotum from just below the external abdominal ring down nearly to the bottom of the scrotum. The cord is exposed and ligated in mass at its upper end; the cord is then cut and the tumor enucleated with the fingers or by blunt dissection. The spermatic, cremasteric and deferential arteries of the cord and the veins should be carefully picked up in the stump of the cord, and ligated, and the first ligature then removed. Pain is said to be produced by including the nerves and vas deferens in the mass surrounded by a single ligature. Bleeding vessels in the scrotum should be carefully secured, as hemorrhage is likely to occur after the wound is closed. The skin is sutured except at the lower end of the wound, where a small amount of drainage is placed, sterile gauze and cotton are applied and held in place by the scrotal bandage of Peterkin.

## HYDROCELE.

Hydrocele is an abnormal amount of fluid in the tunica vaginalis, around the testicle or cord. This is the ordinary variety, in which the fluid is in a sac distinct from that of the tunica vaginalis and known as encysted hydrocele. Still another variety is multilocular hydrocele with a main sac and many smaller ones.

ETIOLOGY.—The causes of hydrocele are various. Among the most usual may be mentioned old age, inflammatory lesions or traumatism of the epididymis, testicle or cord and long-continued slight irritation, while a certain number seem to be idiopathic; that is, no cause can be found. Hydrocele is said to be very common in tropical countries.

PATHOLOGY.—The amount of fluid varies from a few drachms to a pint, which is about the usual quantity. Occasionally, in neglected cases, the amount may reach seventy-five or a hundred ounces. The fluid is an albuminous, straw-colored secretion, which may be stained a brownish red at times, and when trauma or other causes can be eliminated, it is then thought to indicate tuberculosis or a malignant growth. It may also become purulent, or filled with spermatozoa or chyle. When hydrocele has existed for a considerable length of time the walls may become thickened and hardened and obscure the diagnosis. Very rarely the pressure of the fluid may lead to atrophy of the testicle.

SYMPTOMS.—The swelling of the scrotum is painless and comes on very gradually, or may persist from an acute hydrocele. It is of pear shape, with the larger end below. The testicle is usually situated posteriorly, but is sometimes in front and may be injured in withdrawing the fluid, if the exact loca-

tion of the testicle is not ascertained beforehand. The tumor is tense and fluctuates. The cord is its natural size and the swelling does not extend up into the external abdominal ring. The tumor is dull when percussed, and cannot be reduced.

**DIAGNOSIS.**—The most important diagnostic point is the translucency, which may be discovered by viewing the enlargement through a cylindrical roll of paper with a light on the other side of the scrotum. Dark-colored fluid or dense walls render this test negative. Any doubt may be cleared by thrusting a fine trocar into the tumor and withdrawing the fluid. The symptoms previously given and the translucency generally enable one to make a correct diagnosis.

**TREATMENT.**—Absorption of fluid usually occurs spontaneously in acute hydrocele, but in the chronic form permanent relief can only be effected by destroying the cells which line the tunica vaginalis and produce the secretion, or by excising or everting the sac. Temporary relief may be obtained by draining off the fluid through an aspirator or trocar. The scrotum should be washed with soap and water, then with alcohol. A point is selected on the anterior portion, where no blood vessels are likely to be penetrated and while the tumor is made tense, the needle is quickly introduced. The fluid is withdrawn and the point of puncture sealed with a bit of cotton and collodion. Simple tapping should be tried on all hydroceles, as occasionally they do not return. Autoserotherapy has recently afforded a new method of attacking such collections of fluid. From 6 to 8 c. c. of the fluid are withdrawn in a Lenz syringe and immediately injected into the gluteal muscles once or twice weekly. We have secured excellent results in three patients so treated. We are the first to treat hydrocele in this manner.

**RADICAL TREATMENT.—INJECTION METHOD.**—This plan of treatment is advisable for translucent hydroceles, regardless of their size. The carbolic acid injection, suggested by Lewis, and modified by Keyes, is the best of the injection methods of

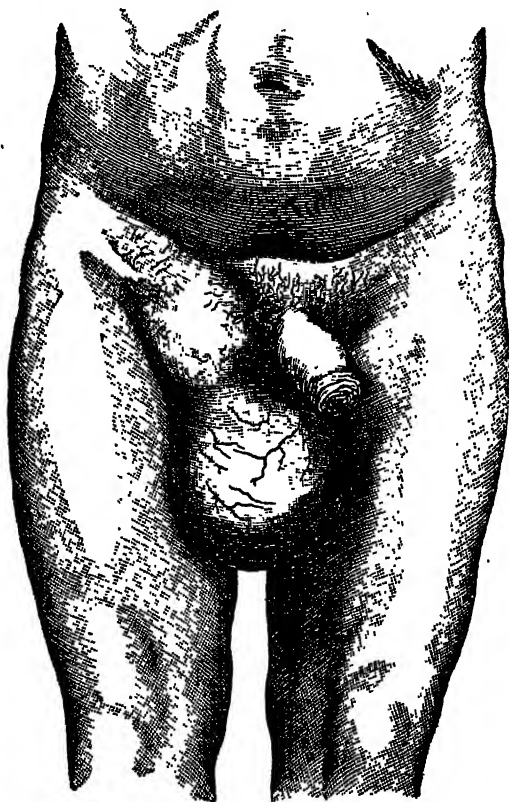


Figure 62.—Hydrocele. (Casper.)

curing hydrocele. The fluid is aspirated and the cavity irrigated with normal salt solution. Forty minims to one drachm of pure carbolic acid is then injected, the amount varying with the size of the hydrocele. The scrotum is manipulated for a moment to insure diffusion of the acid. After the operation, the patient should be placed in bed for a day or two, according



to the reaction which follows. This should be lessened by applying ice bags or poultices. The pain, if severe, may be controlled with morphia.

The effusion which forms after the operation may be very slow to be absorbed, but it will usually, eventually, disappear entirely. No anesthetic is required.

THE BOTTLE OPERATION for the radical cure of hydrocele (Pratt, Dozen, Winkelman, Andrews) is the most satisfactory of the open methods, and is described by Andrews essentially as follows: The incision is made in the upper anterior portion of the scrotum, and is of sufficient length to allow the enucleation of the hydrocele sac and the inclosed testicle. The skin is then held tense and a dissection carefully made to the exact layer which will enable the translucent, bladder-like mass to be enucleated from its bed in the scrotum. Another incision, about two cm. long, is made in the upper funicular portion after the sac has been freed. When the sac has been emptied it is like a bottle or bag with a hole at the top. Dilating this slightly with one or two fingers the orifice is held open, and the testis is pushed up into it. In a moment the testicle can be easily squeezed through, when the whole sac will instantly be everted, with the small button-hole so closely surrounding the cord that it is scarcely visible and does not need stitching.

The skin is closed with light sutures, and does not need drainage. The patient can usually be out of bed on the third or fourth day. This operation may be done with local anesthesia.

Where there is doubt as to the diagnosis or where the contents contain pus or blood, the Volkmann operation should be employed. The serous membrane is sutured to the edge of the skin, all around the incision; the cavity is drained and dressed antiseptically. This is harsh treatment, and is never necessary in simple hydroceles.

FOUR-TAILED GENITAL BANDAGE.—A useful bandage for inflammations of, or operations on, the scrotum or testes has been described by Peterkin, as follows: The length of the band-

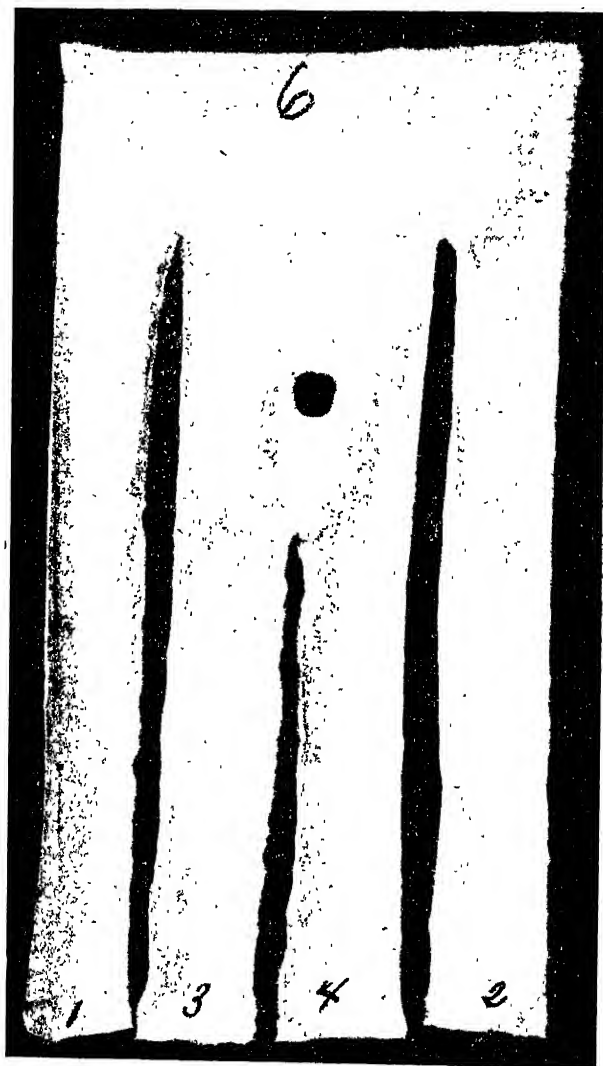


Figure 63.—Peterkin's scrotal bandage.

age is obtained by measuring from the anterior superior spine of the ilium to the end of the external malleolus; the breadth is one-half the circumference of the abdomen. After obtaining measurements, fold the material once its greatest length; nick the border where folded, and then nick the two halves so as to divide them into two equal portions. Now tear into strips, as shown in illustration, to within four inches of the other end. Wind these around the waist, from before backward and tie in front. Slit the middle portion after the bandage is applied, so that the end of the tear will reach just behind the scrotum. While holding the bandage in position, place a piece of cotton behind the scrotum so that the bandage will not chafe and will push the tests forward. Also apply what other dressing may be necessary. Next draw three and four so as to form a pocket that will hold the testes snugly, and then pass between the legs, cross at the perineum and tie at the back. After oozing has ceased an ordinary scrotal suspensory affords a satisfactory method of holding the dressing upon the scrotum.

**CONGENITAL HYDROCELE.**—This variety of hydrocele is due to incomplete obliteration of the neck of the scrotum, which leaves an opening between it and the peritoneal cavity and allows the fluid from the abdominal cavity to gravitate into the tunica vaginalis. Its cure can usually be effected by the use of a closely fitting truss. If after the obliteration of the neck the fluid is slow to be absorbed, it may be treated as an ordinary hydrocele. The injection treatment should never be given, however, until the opening into the peritoneal cavity is completely closed.

**SPERMATOCELE** is a hydrocele which contains spermatozoa, and can only be diagnosed by a microscopic examination of the milky fluid withdrawn. The treatment is the same as of a simple hydrocele.

DIFFUSE OR ENCYSTED HYDROCELE OF THE CORD may exist as a round, smooth uniform swelling, which cannot be reduced, does not give an impulse on coughing, and may be mistaken for hernia.



Figure 64.—Peterkin's scrotal bandage applied.

HEMATOCELE is a collection of blood in the tunica vaginalis, in the testicle, in the cord or its tunic. It is caused by traumatic injuries or muscular strains, and is characterized by the rapid formation of a painful tumor from which blood or bloody fluid may be aspirated.

The treatment consists in rest, elevation of the parts, the application of soothing lotions and the ice bag. If much swelling persists after the acute symptoms have subsided the contents of the tunica vaginalis should be evacuated through a free incision in order to prevent the formation of a chronic hematocele. This last named condition may also arise from inflammation of the testicle or epididymis. It is smooth, tense, elastic, non-transparent and rapidly increases in size at irregular, recurring periods. As it has no tendency toward a spontaneous cure it should be treated by incision and curetting, decortication, or castration.

**THE SPERMATIC CORD.**—The cord is made up of the vas deferens, arteries, veins, nerves, and the remains of the peritoneal process which extends from the abdomen to the tunica vaginalis. Surrounding these vessels and nerves are meshes of connective tissue containing unstriped muscular fiber. The arteries are the spermatic from the aorta, the deferential from the superior vesical, and the cremasteric from the epigastric. The veins from the testicle and from the epididymis unite in the pampiniform plexus and constitute the bulk of the cord.

**LIGATIONS OF THE VAS DEFERENS** has come into prominence in recent years on account of its adoption as the best method of sterilizing diseased and criminal males without affecting their sexual power. The operation is simple and may be performed painlessly with cocaine anesthesia. The scrotum is thoroughly cleansed and the vas is brought up close to the skin, where it is held by a needle piercing the scrotum. An incision is then made through the skin, the vas (which feels like a hard cord) is dissected free and ligated with silk. The vas is cut below the ligature and the skin incision closed. This operation is thought by some to be better than a resection of a segment of the vas. Dead spermatozoa may be found in the semen for many

weeks after ligation of the vas. All criminals, rapists, idiots, and epileptics should be required by the state to undergo this operation.

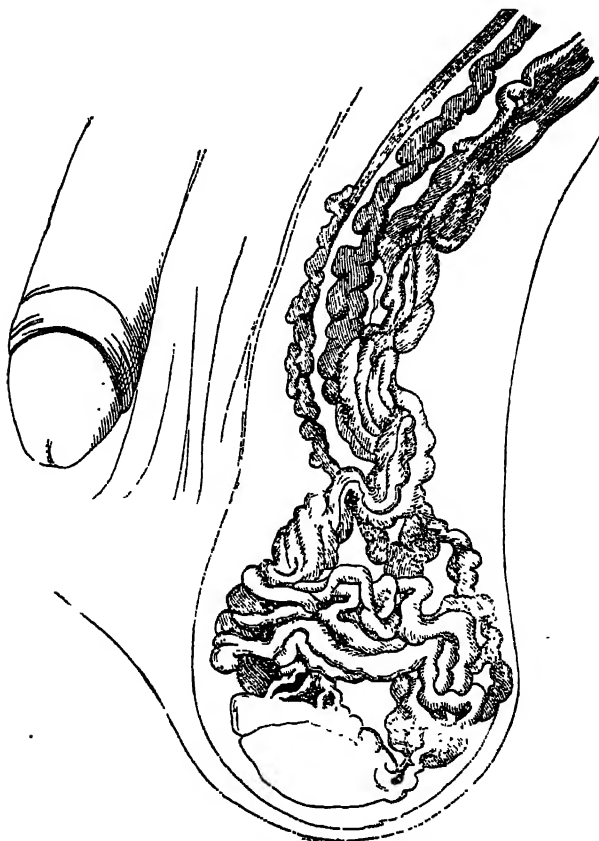


Figure 65.—Dilation of the veins in a marked case of varicocele. (Kocher.)

Sharp describes as follows vasectomy as he performs it; gives his reasons for operating in this manner:

“After cleansing the scrotum with soap and water I bathe the part in alcohol, then grasp the spermatic cord between the thumb and the index finger of the left hand, detect the vas, hold it firmly and fix it with a pair of bullet forceps, then cut down

on it, draw it through the scrotal wound by means of a tenaculum hook, strip it of all membranes and the accompanying artery, ligate above and sever, cutting away any portion from the vas that may have been damaged in the manipulation. This is done in order that the end next to the testicle may not become closed. It is very important that it shall remain open, in order that the secretion of the testicle may be emptied around the vessels of the pampiniform plexus and there be absorbed, for it is through this process that the economy receives the tonic effect of the secretion also where the end closes there is likely to be cystic degeneration of the testicle. The action of the muscle closes the wound, and no stitch, collodion or adhesive plaster is needed. The patient returns to his work immediately and suffers but little inconveniences."

**VARICOCELE.**—Varicocele is a varicose enlargement of the veins of the cord. It appears most frequently in early manhood, and in mild form is of most common occurrence. About 90 per cent. of the cases occur on the left side.

**SYMPTOMS.**—A mass of tortuous veins which feel like a bundle of worms can readily be made out even by a most casual examination. They may disappear when the patient lies down. The scrotum is elongated and may have a dusky, purplish color; in a patient with well marked varicocele, the testicle may atrophy. No special symptoms are caused by varicocele except occasionally pain in the testicle, back or penis, and perhaps sexual neurasthenia.

**DIAGNOSIS.**—The diagnosis involves little uncertainty, the wormy feel and tortuous veins can hardly be mistaken for anything except possibly omental hernia. The latter condition, if reduced, can be prevented from returning by pressure at the external abdominal ring when the patient rises, while a varicocele will return, the veins filling from below upward.



Figure 66.—Varicocele.



**TREATMENT OF VARICOCELE.**—If of small size and not producing discomfort or neurasthenia, little need be done other than to have the patient wear a properly fitting suspensory, avoid severe muscular strains, keep his bowels regulated, and take daily a cold sponge bath of the scrotum.

When of large size, causing atrophy of the testicle and reflex symptoms, radical treatment is indicated. The best method is excision of the dilated veins and shortening of the cord. This may be done under local anesthesia. An incision about two inches long is made over the varicocele down to the veins, which are then freed for two or three inches of their course by carefully dissecting the many layers of fascia surrounding them. A small vein should be left and care taken not to include the artery and vas among the veins.

A cat gut ligature is placed around the bundle of veins at the lower end of the incision; another ligature is placed around them at the upper end; these are finally tied with a triple knot and clamped with a hemostat until the intermediate portion is cut out. Two ends of the veins are brought together with running cat gut sutures until a firm union is secured, including the fascia surrounding the veins. The ligatures placed around the entire bundle of veins are now tied together. If the scrotum is very long and flabby the lower part of it may be amputated; a scrotal clamp is fixed in place and the scrotum is drawn through until it is moderately tight over the testicles; the redundant portion is then cut away and cat gut ligatures introduced. A sterile dressing should be applied and held in place with Peterkin's scrotal bandage.

**SUBCUTANEOUS LIGATION.**—The operation may be performed as follows: The mass is rolled between the fingers in order to separate the veins from the cord, which is pushed back so as not to be included in the ligated mass; two small, straight needles are threaded on a single strand of silk; one of the needles

is carried through the scrotum between the cord and the veins, the other needle is then introduced through the opening made by the first needle and is carried in front of the veins and out along with the ligature on the opposite side. Thus we have the two ends of the silk protruding from a tiny puncture and the loop surrounding the veins to be ligated. The ends are then carefully tied and cut in order to allow the knot to disappear. In a similar manner another ligature may be passed around the veins, higher up. Of course a careful technic should be carried out so as to avoid infection.

**SUMMARY.**—**ORCHITIS** is an inflammation of the testicles and is most frequently caused by mumps; other causes are traumatism, typhoid fever and excessive sexual excitement, less frequently tonsillitis, gout, smallpox and scarlet fever. It causes an intense sickening pain and frequently produces a subsequent atrophy of the testicles. Prompt incision may prevent this atrophy. The other treatment is similar to the treatment of epididymitis.

**TUBERCULOSIS OF THE TESTICLE** usually arises secondarily to primary infection of other organs, especially when such infection affects the genito-urinary tract. Pain is less severe than in acute epididymitis or orchitis, but the swelling persists and later degenerates and forms a sinus. The treatment is chiefly dietary and hygienic. If the disease is primary, castration should be performed.

**TUMORS OF THE TESTICLE** are benign or malignant and should as a rule be excised. A general anesthetic is usually necessary. The cord is exposed and the blood vessels are ligated separately.

**HYDROCELE** is an abnormal collection of fluid in the tunica vaginalis. The causes are usually associated with old age, trau-

matism and inflammation of the epididymis or cord. It is a slow painless enlargement which is usually translucent. The treatment may be by tapping, which usually affords only temporary relief, or by the injection of 40 to 60 minims of pure carbolic acid into the tunica after it has been irrigated with physiologic salt solution. The bottle operation or inversion of the tunica is the method to be preferred as it effects a permanent cure. It should be remembered that congenital hydrocele may be connected with the peritoneal cavity.

VARICOCELE is a dilation of the veins of the cord and is of very frequent occurrence. The veins should be exposed under cocaine anesthesia and ligated above and below; the intermediate portion is then excised and the cut ends sewed together. A less satisfactory operation is subcutaneous ligation.

## CHAPTER XXI

DIAGNOSTIC AIDS IN THE SURGERY OF THE  
BLADDER, KIDNEY AND URETER.

ROUNDTREE AND GERAGHTY'S TEST, X-RAY PICTURES, THE  
CATHETER STILET, CHROMO-URETEROSCOPY,  
INDIGOCARMIN TEST, PYELOGRAPHY  
AND SUMMARY

Few branches of surgery have made greater advances in recent years than has renal surgery, especially in regard to the accuracy in diagnosis. The accuracy has produced a corresponding reduction in the mortality. It further affords the operator, as a rule, ample assurance that the conditions are understood, that the diseased part is being treated and that a kidney with good functional capacity exists on the other side. Both subjective and objective symptoms are often misleading without the aid of the X-ray, cystoscope and urethral catheterization. The refinements in diagnosis are of such vital importance to patients with renal and ureteral lesions that no half-way diagnosis should ever be made.

The use of the X-ray should always be considered as a part only of the clinical picture, and other supplementary facts should be supplied and a careful interpretation of all the data should be made if we are to escape the grave situations that may arise from "snapshot" diagnosis. For routine examination a twenty-four hour specimen of urine should be analyzed. The presence of blood in the catheterized specimen may be the results of traumatism produced by the passage of the catheter into the ureter. It is, therefore, evident that the control analysis should be available for comparison. Before X-ray examinations the patient should be thoroughly purged with castor oil the day

before, and an enema should be administered the morning of the day of the examination. The diet should be restricted to liquids for the preceding twenty-four hours. The patient should recline on his or her back with the thighs partly flexed upon the abdomen so as to bring the back close to the plates. Rapid plates should be used and the tube brought as close down to the abdomen as possible. The patient holds his breath while the exposure is being made. With first-class X-ray machines the time of exposure varies from one-half to one or five seconds. The question of interpretation after the plates are developed needs more than ordinary discrimination. Cystoscopic examination should then be made and catheters introduced into the ureters. The specimens of urine collected from each side are studied separately and compared with the specimen voided before the examination was commenced. One c.c. of the phthalein solution as used by Roundtree and Geraghty should then be injected intramuscularly and the time of its first appearance in the urine noted. The promptness with which this appears in the urine and the readiness with which it is eliminated affords one of our best tests of renal functional activity. A stilet may be passed into the catheters, which are then inserted to the pelvis of the kidney, or collargol may be injected for other X-ray pictures. Care should be taken not to insert a stilet that is longer than the catheter. Overdistention with the collargol solution should be avoided. A set of stereoscopic plates aids much in locating a shadow. A phlebolith or calcareous deposit in the wall of the ureter may occupy a position so close to the ureter as to make the diagnosis uncertain. Of course all of the tests described cannot be done at one sitting, nor are they necessary in every instance. The tests should be done until the clinical and other evidence indicates the character of the lesion. Phleboliths may occur singly, or in groups or rows on one or both sides and may be with difficulty differentiated from stones, especially if they are shown on the side where we suspect trouble. Renal tuberculosis may show

shadows simulating stone in the kidney. Braasch says that the shadows are probably caused by lime-salts in caseous tubercles. The cystoscope and clinical facts in addition to the X-ray findings usually enable one to make a differential diagnosis. Gallstones are occasionally found.

ROUNDTREE AND GERAGHTY'S PHENOL-SULPHONE-PHTHALEIN TEST OF THE FUNCTIONAL CAPACITY OF THE KIDNEYS.—This is the best of the tests to determine the functioning power of the kidneys. Taken in connection with the tests for albumin, casts, chromocystoscopy with indigocarmin, specific gravity and the rapidity with which the quality of urine increases when an additional amount of water is consumed, we are enabled to ascertain with more than ordinary accuracy the condition of the kidneys. We utilize this phthalein test in all instances where we wish to know the condition of the kidneys to anticipate and thus minimize the danger of the post-operative anuria by the application of appropriate measures before the operation. If the condition is non-operative we think this test affords a valuable guide in making the prognosis in Bright's disease. Where we expect to operate upon the kidney we catheterize the ureters and apply this test to each kidney separately, and thus far it has not misled us in thinking a kidney had good functional capacity when it did not. The test deserves a much more general adoption on account of both its value and its simplicity. Geraghty, who was one of the originators of the test, describes it as follows and gives his results after its extensive application in many renal affections:

"The technic of estimating the total function without the use of urethral catheters is as follows: One c.c. of phthalein solution (6 mg.) is injected deep into the muscles, preferably the lumbar muscles, and the patient instructed to void at the end of one hour and ten minutes, and again at the end of two hours and ten minutes from the time of the injection, each

specimen being kept separate. The drug should appear normally in about ten minutes, and this much time is consequently allowed for its appearance. In this method no account is taken of the time of appearance, the main reliance being placed on the quantity excreted. This method is extremely simple.

"In cases with urinary obstruction a catheter must be employed. The time of appearance is estimated in these cases, the collection being made for two separate hours from the time of appearance of the drug in the urine. When the phthalein excretion is high for the first hour it is unnecessary to continue the test longer. The estimation of the amount of drug excreted is made by means of a modified Hellige colorimeter. The estimations can be made quite accurately for practical purposes by means of two graduated test-tubes. When the test is used in conjunction with ureteral catheterization the injection is made intravenously, and the urine collected for two separate fifteen-minute intervals, the time of collection beginning with the appearance of the drug on the first side. When the kidneys are functioning smoothly, and the function is being measured simply to determine the efficiency of the remaining kidney, should nephrectomy be performed, a collection for fifteen minutes is usually all that is necessary. If the second kidney is normal, a high excretion of phthalein will occur, sufficient to indicate its efficiency. When, however, both kidneys are diseased or when the functional estimations are being made for purposes of diagnosis, comparison of the two kidneys being desired, periods longer than fifteen minutes must be employed. For short periods the kidneys normally vary much in the relative amount of work which each one performs, but if the time of collection is one hour the variation will be slight. When very accurate relative estimations are desired intramuscular injections and collection for one hour should be made. The total function without the use of the ureteral catheters is always determined in these cases for purposes of comparison with the sep-

arate function and to check up the amount of catheter inhibition should this occur.

"The test has been employed now in over 20 cases of nephritis of varying types, approximately 350 cases of urinary obstruction, mostly prostatic cases, in 150 cases of unilateral or bilateral disease in conjunction with a thousand other cases as part of a routine examination. Our added experience confirms entirely our early conclusions regarding the reliability and accuracy of the test. In the milder form of so-called glomerular or parenchymatous nephritis the definite clinical evidence of renal disease seemed at first irreconcilable with the relatively high phthalein output. Phthalein is eliminated almost if not entirely by the tubules, so the presence of glomerular disease would not necessarily cause decreased phthalein elimination. The glomeruli, however, are rarely severely diseased without considerable resultant damage to the tubules, and the greater the tubular injury the more marked the phthalein decrease. In these cases with disease of long standing, the elimination is markedly decreased. In the chronic interstitial type of nephritis individuals with low phthalein excretion are occasionally seen in whom no evidence of uremia is present, and there is somewhat of a tendency for this reason to doubt the accuracy of the test. There have been some such cases in our series, and in these death resulted some months later from uremia. Autopsy in each case proved the presence of a very advanced chronic nephritis. In the routine examination of patients, one was found whose excretion of phthalein was 7 per cent. for two hours, although no suspicion of any renal disease was entertained in this case. The most careful examination failed to give any evidence of the existence of a nephritis. The patient was kept under observation, and a few months later suddenly developed uremia which ended in death. Autopsy showed an extreme grade of chronic interstitial nephritis.



"In thirty-five cases the opportunity has presented itself for verifying the accuracy of the test at autopsy. The lesions as revealed correspond closely with the efficiency, as shown by the test. In one case with a practically normal output, a moderate grade of double polycystic kidney was found. The urine itself showed no abnormalities, and the condition was unsuspected. In thirty cases a nephrectomy has been performed and an opportunity afforded of comparing the pathologic picture with the function, as shown before operation. The phthalein excretion and the amount of kidney destruction seemed to correspond in a striking manner. It would be well to remind those using the phthalein test that it is only a test of the excreting power of the kidney, and not a test of the normal or abnormal function of other organs. It furnishes, when taken in conjunction with the ordinary clinical examination, accurate information which can be obtained at the present time in no other way. With added experience we find no reason to change our previous views as regards the accuracy of the test in measuring the excretive power of the kidneys."

TECHNIC OF MAKING X-RAY PICTURE OF THE KIDNEY REGION.—A good plate depends upon many factors. Derr describes as follows his technic:

"A good machine, a tube of the proper vacuum, a skillful technic and the proper development and interpretation of the plate after it is obtained. The preparation of the patient may also be an important factor in the result, as masses of feces and bubbles of gas in the intestines destroy the clearness of the X-ray negative, and the former may even simulate a stone. The intestinal tract should be thoroughly cleared with castor oil and food should be sparingly taken of before the examination. This is made with the patient in the dorsal position and the lumbar curve brought down to the table as closely as possible, the plate ; placed beneath, and extending from the 10th rib down.



Figure 67.—Double ureter on right side. Collargol injected into all three ureters. Upper part of right kidney was unfortunately cut off by lithographers in preparing cut. (Dr. W. S. Goldsmith.)

ward to the iliac crest. On very stout subjects the abdominal binder will be found useful to reduce the thickness of the abdomen. In all cases the compression diaphragm of Albers-Schonberg with hemispherical aluminum window is of great advantage to push the intestines out of the path of the rays. The cone should be tilted at such an angle as to throw the line of focus upward beneath the costal border, if possible; the degree of the angle to be suggested by the anatomy of the patient. By this procedure the kidney is penetrated diagonally and its shadow is brought out with the greatest possible distinctness, the distortion produced being very trifling. Unless the patient is small, I find it best to make a separate focus and exposure for each kidney.

"For examining the ureter for stone, the focus of the tube should be directed downward at a considerable angle in order to project the shadow through the pelvic canal and on the plate. My apparatus is a 4 k.w. Waite & Bartlett Transformer, running at 110 volts, direct current. The character of the Roentgen tube should be such that 40 to 50 milliamperes of current can be passed, using the full power. The softer the tube the better, provided it has the necessary penetration. This tends to bring out the greatest amount of detail in soft structures, such as the psoas muscle, liver and spleen. Too hard a tube, too long an exposure may penetrate the calculus.

"The time of exposure varies according to the thickness of the subject from two to five seconds by time switch. Such a technic renders it possible to make as many exposures as may be desired, without the slightest danger of injury to the patient. In the early days of the X-ray, it was not uncommon to expose for 30 to 40 minutes in efforts to penetrate the abdomen, and a case is on record of a woman who after three such exposures developed a sloughing wound from which she died. The dread of the X-ray burn still persists in the minds

of many who are not familiar with the advances made in modern technic. The exposure is made while the patient holds his breath, either in expiration or inspiration; both have their advantages in particular cases, though, as a rule, the former is the best, as the kidneys move downward with the diaphragm and the costal margins are more elevated."

**THE CATHETER STILET.**—Kolischer and Schmidt first suggested the introduction of a ureteral catheter containing a wire stilet, hoping thus to identify doubtful ureteral and kidney shadows. While this method is of value it is not infallible even when the radiograph is taken at different angles. Looking at the plates through a stereoscope, so as to apparently add depth, aids in the localization of shadows. Instead of the stilet the catheter may be filled with a saturated solution of colloidal silver and then introduced. This is even better than the stilet, as a kink in the ureter is less likely to be obliterated. If the catheter meets an obstruction in the ureter and the urine flows freely after it passes, the probability is that the suspected shadow is a stone. To obtain the best results in the diagnosis there should be close co-operation and teamwork between the surgeon, the cystoscopist and the radiologist.

**CHROMO-URETEROSCOPY.**—Voelker and Joseph devised this test, using indigocarmin. We think it comes second to the phthalein test, though each has certain advantages the other does not possess. Both should be used when needed. There are times when it is inadvisable to catheterize the ureters to determine the functional capacity of the kidneys; in such instances the indigocarmin test is of value. It has a further advantage of not producing a mechanical action as sometimes does the ureteral catheter in temporarily causing a stimulation or suppression of the renal function. The ureteral catheter may not catch all of the urine and the part escaping into the bladder

may cause an erroneous deduction unless a control test is made of the fluid in the bladder. In this respect the indigocarmin test has an advantage. Chromo-ureteroscopy is simpler because the ureters do not have to be catheterized in making a unilateral determination.

**THE TECHNIC OF THE INDIGOCARMIN TEST.**—The patient is prepared as usual for cystoscopy. Four c.c. of 4% of indigocarmin are injected intravenously or into the gluteal muscles, the exact time being carefully noted. The openings of the ureters are then watched until blue urine is seen to flow from them. Thomas found that indigocarmin is eliminated from functionally sufficient kidneys as a dark blue in from three to twenty minutes, and as a light blue not later than fifteen minutes. In 90 per cent. of kidneys it appeared either as a dark or light blue in fifteen minutes; in 61 per cent. it was observed in ten minutes. He also observed that morphine and ether delayed the appearance of the dye. The intensity as well as the time of the appearance should both be noted and recorded. A delay of more than 20 minutes means renal insufficiency. Regarding this Thomas says: "Although the exact time limit for functionally sufficient kidneys has probably not yet been definitely determined, my experience has indicated that, in the event of the excretion of the dye as a dark blue, it should be placed, for the present at least, at twenty minutes; while if the elimination occurs as a light blue, fifteen minutes should be the time limit. This applies strictly to prognosis in view of nephrotomy, the figures will vary and no time limit can at present be stated. In nephrectomy likewise surgical technic and skill, proper selection and administration of anesthetics, post-operative treatment and renal reflexes play a most important role with respect to recovery. These are variables which no functional kidney test will ever gauge. The onset of the excretion

of the dye as a light blue after fifteen minutes and continuing as such undoubtedly indicates functional degeneration of the respective kidney. Precisely at what minute the ultimate time limit for function sufficiency of such a kidney expires, is at present undetermined." Each ureteral orifice should be observed alternately to see the differences in the intensity of the color.

**PYELOGRAPHY.**—Voelker, in 1906, demonstrated that a solution of collargol injected into the ureter and pelvis of the kidney would produce a shadow on the X-ray plate. Three years later Braasch applied this method at St. Mary's Hospital, and has now used it in more than 600 cases. Many others have confirmed its value. The method is not entirely devoid of danger if care is not exercised in the selection of the patients or if too great pressure be used in injecting the solution. Collargol 15% or argyrol 25% will either produce a shadow, though the former is better. In this manner we may outline the lumen and the cavities of the ureters and kidney, and thus show their normal or abnormal characteristics. The ureters are first catheterized and then the solution is injected by the gravity method, so as not to overdistend the pelvis. The X-ray picture is immediately taken—previous purgation and restriction of the diet having been carried out. Its chief value lies in its showing us the extent and character of dilation of the ureter or renal pelvis; deformity accompanying renal tumors; and congenital anomalies. Braasch says that in the majority of instances of stone in the ureter there will be more or less ureteral dilation above it, provided the injected medium can pass the obstruction. He thinks that when the injected ureter shows no dilation above a doubtful shadow, we can, as a rule, infer that the shadow is not due to a stone. Braasch says further that it has been their experience at the Mayo clinic that a distinctly abnormal pelvic outline or other evidences of tumor involvement can be demon-

strated in pyelograph in the majority of renal tumors. The pelvic changes must be well marked in order to be recognizable. "They will consist of —(1) Retraction of individual calices, presenting striking bizarre outlines; (2) irregular distention of the entire pelvis; and (3) obliteration of the pelvic lumen, partial or complete." Retraction of the upper ureter by surrounding renal neoplasm may be confirmatory evidence. The relation of the injected pelvis to an unidentified tumor may also be of differential value. In our own experience with pyelography we had no ill effects following its use, and have obtained much valuable information from its application, in those instances where additional facts were necessary to complete the diagnosis.

In preparing the collargol care should be taken to powder all masses and then filter so as to remove particles that might be left in the kidney. The collargol cannot be sterilized by heat; it should, therefore, be prepared in a strictly aseptic manner. It should be injected until slight pain is produced. This test should never be used when there is a fully developed hydronephrosis or pyonephrosis.

Kelly and Lewis have recently recommended the use of a 5% solution of silver iodid emulsion. They claim that it casts as dark a shadow as does an equal amount of a 10% collargol. It is antiseptic, non-irritating, clean and inexpensive.

**SUMMARY.**—The refinements in renal diagnosis have rapidly advanced in recent years so that subjective and objective symptoms must always be verified by the X-ray, cystoscopy, ureteral catheterization, and the phthalein tests. All of these are usually necessary to supplement the symptoms before a correct diagnosis can be made.

**ROUNDTREE AND GERAGHTY'S TEST.**—The promptness with which phenol-sulphone-phthalein appears in the urine and the amount passed in the urine during the first one or two hours

after 0.06 has been injected intramuscularly affords a valuable test of the renal functional capacity.

CYSTOSCOPY becomes absolutely necessary in the majority of instances where ureteral catheterization is necessary, or when bladder lesions are suspected. The greatest care should be exercised in carrying out the technic to avoid infection or traumatism.

IN MAKING X-RAY EXAMINATIONS the patient should have the intestinal tract well cleansed by a regulation of the diet, and purgation with castor oil. The machine should be a good one, the tube of the proper vacuum and the plate properly developed.

The interpretation of the plate requires experience and collateral evidence. While making the exposure the patient should be instructed to hold his breath. Too hard a tube or too long exposure may penetrate the calculus and not give the desired picture.

THE CATHETER STILET.—As calcareous glands in the course of the ureter may be mistaken for stones, the stilet may afford valuable aid in reaching a probable conclusion. Even better than the stilet is a catheter filled with a saturated solution of colloidal silver. Co-operation between the urologist and the radiologist is necessary for good results in making these determinations.

THE INDIGOCARMIN TEST may be employed with advantage at times when it seems inadvisable to catheterize the ureters. Four c.c. of 4% of indigocarmine is injected intramuscularly; the openings of the ureters are then observed until the blue urine appears.

PYELOGRAPHY.—Collargol 15% or argyol 25% injected into the pelvis of the kidney casts a shadow on the X-ray plate and thus shows the size and shape of the lumen of the ureter and renal pelvis.



## CHAPTER XXII

## DISEASES OF THE BLADDER

CYSTITIS, ETIOLOGY, BACTERIOLOGY, PATHOLOGY, SYMPTOMS,  
DIAGNOSIS, PROGNOSIS, TREATMENT, TUBERCULOUS  
CYSTITIS AND SUMMARY

CYSTITIS.—The somewhat complex etiology and pathology of this disease, on account of its close relationship to nearly all the important genito-urinary diseases, precludes more than a brief discussion of the essential features.

The rapid advances in renal and prostatic surgery within recent years, in addition to the great improvements in the diagnosis of all bladder diseases which have been made possible by the cystoscope and microscope, have cleared up many doubtful points in cystitis; nevertheless there are several important questions that can only be solved by careful routine examinations in the future.

ETIOLOGY.—The etiology is apparently dependent upon two conditions: First, a predisposition; second, a pyogenic infection.

The exact manner in which all the predisposing causes act is not entirely understood. The most frequent conditions that cause cystitis are stricture, prostatic hypertrophy, vesical calculi and neoplasms; congestion of the pelvic viscera from any cause whatever, traumatism, foreign bodies, instrumentation, parasites, uterus displaced anteriorly, exposure to cold, strong diuretics, balsams, cantharides, turpentine, urethritis, gout, diabetes, nervous diseases and especially those involving the spinal (Spooner.)

The promptness of a cure under appropriate treatment depends upon removing the predisposing cause, as there is always a tendency for suppuration to clear up if this is removed. Retained urine and the engorgement of the mucous membrane which attends it furnish a most favorable soil for the growth of micro-organisms.

Lowered resisting power from systemic weakness makes it possible for microbes to flourish and produce a severe cystitis.

BACTERIOLOGY.—Under favorable conditions any pyogenic organism may set up a cystitis. Those most frequently encountered are the *bacillus coli communis* group, *streptococcus*, *staphylococcus aureus*, *albus* and *citreus*, several varieties of the *proteus*, *bacillus pyocyaneus*, *bacillus lactis erogenes*, and the *micrococcus urea*.

The position of the *gonococcus* has not been definitely settled. The general opinion is that there is a certain number of cases where it is the actual cause of cystitis, but in the majority of cases it seems to pave the way for some other pyogenic microbe. Infection with the tubercle bacillus may follow a chronic gonorrhoea, especially where it has been neglected.

The *staphylococcus citreus*, the *proteus vulgaris*, the *micrococcus urea* and this type of saprophytic micro-organisms have the power of decomposing urea.

There are a number of infectious diseases, as scarlet fever, typhoid fever, diphtheria, etc., in which the germs are apparently eliminated through diseased points in the kidney and inflammation of the bladder may occur during the height of the disease or during convalescence. The urine may be swarming with bacteria (*bacteriuria*) without there being any evidence of a cystitis, and patients have gone for years secreting urine full of tubercle bacilli from the kidneys without causing a cystitis. The kidney, however, is a frequent source of tuber-

cular infection, while nearly all suppurative cystites are caused by infection through the healthy or diseased urethra.

Kelly claims that, in women who have borne many children and have patulous urethras, infection may travel up from the vulva to the bladder, while Swart believes that cystitis in children, especially in girls, is caused by the colon bacillus, which may migrate from the rectum into the urethra. The latter observer urges that in children suffering with enteritis, especial care be taken to avoid soiling the vulvar parts with the fecal discharges. Guyon has shown that the microbes are attenuated by frequent emptying of the bladder and its occasional disinfection and advises that all operations be postponed, when possible, until the organisms are in this state of hypovirulence. Westphal reports a case of cystitis caused by the malarial plasmodia.

**PATHOLOGY.**—Simple catharrhal cystitis shows hyperemia of the mucous membrane with cloudy and swollen epithelium which may be coated with tenacious mucus, rich in pus-cells and epithelia. This usually begins in the neck and trigone where the inflammation is most severe.

In chronic inflammation the formative changes are very marked and the mucosa is thickened by the round-cell infiltration, which gradually changes to fully formed connective tissue.

Hemorrhage in chronic cystitis, as a rule, means that there is an ulceration.

Membranous cystitis is not so rare and is seen in cord disease, or injury from pressure during childbirth, and from excessive distention of the bladder. Ulcers occur at times in both acute and chronic conditions, and are usually located in the base or around the ureteral orifices.

Phlegmonous and gangrenous cystitis are very severe in . Their names indicate the conditions that exist.

Hypertrophy of the muscular coat occurs in all chronic cases. This is not regular, but there are ridges, which give the bladder a corrugated appearance. If this condition of thickening progresses and lessens the bladder capacity, it is called concentric hypertrophy. Fatty degeneration and retention of the urine may result in distention of the bladder which is called ex-centric hypertrophy. The mucous membrane frequently pouches through the weakened areas, forming sacculations. These are favorite seats for stones.

Tuberculous lesions begin as nodules in the mucous membrane which caseate and finally form ulcerations. It may not be until this stage that tubercle bacilli can be found in any number.

SYMPTOMS.—The symptoms may be constitutional in acute conditions and in chronic where toxins are being absorbed from the infected bladder. Pain is nearly always present, but varies much in character. It is usually worse when the bladder is full or completely empty or during the passage of urine, if the inflammation is severe or if there is urinary obstruction. The pain of tubercular cystitis is very similar to stone, and often secondary infection is initiated by a careless exploration. There is tenderness on palpating above the pubes or through the rectum in acute cases, but it is less marked in chronic and tubercular patients. Frequency of urination is always found, and varies from a slight increase to a constant desire, only a few drops being passed after straining. Frequency may depend upon one or more of several causes: very severe inflammation, especially of the vesical neck; retention of part of the urine each time; lessening of the capacity of the bladder by concentric hypertrophy. Pus in the last glass is usually due to cystitis, if the kidneys are not involved.

DIAGNOSIS.—Pain, frequency of urination, tenderness and pyuria, in the second glass, are nearly always indicative of cystitis. A stone impacted low down in the ureter may give symptoms very similar to cystitis.

The urine in inflammation of the bladder contains, in addition to pus, mucus, bladder epithelium, red blood-cells and sometimes a heavy crystalline deposit. It has a cloudy appearance, and if allowed to stand, a whitish precipitate settles to the bottom, leaving the urine above clear if acid; the urine remains cloudy if alkaline and the cells and mucus are altered in appearance. The free ammonia decomposes the pus, forming a gelatinous substance very similar to and often mistaken for mucus. The urine has a foul, disagreeable odor in the severe cystitis. Albumin is always found, but this may not be of renal origin, and should not be so diagnosed until after the demonstration of tube casts. A microscopic examination of the stained sediment of the urine should be made, and in a certain number, where the cause is not clear or the symptoms do not yield to ordinary treatment, a cystoscopic examination is advisable in order to locate accurately the primary trouble and to direct rational treatment toward its removal.

The urethra, prostate, seminal vesicles in men, and the pelvic organs of women should always be carefully examined. The urine should be studied by inoculation experiments, if necessary, in a search for tubercle bacilli. The tuberculin test is fairly reliable, the symptoms pain, frequency and tenesmus being made temporarily worse.

The differential diagnosis is especially important if cystotomy is contemplated, for the good results that follow in an intractable cystitis due to pyogenic infection cannot be expected in tubercular conditions.

Blood in the urine may be an early and an intermittentptom in tubercular cystitis, but it is never profuse, as in cases of the bladder. Usually it occurs as terminal hematuria:

**CYSTOSCOPY**—To Nitze belongs the credit of discovering and perfecting the cystoscope. Its modifications are too numerous to mention. It is one of the most important adjuncts in the diagnosis and treatment of the bladder. (See Technic.)

For a successful examination the urethra and prostate must admit of the easy introduction and manipulation of the cystoscope. The bladder must hold from 90 to 120 grams (3 to 4 ounces) of fluid, and bleeding must not be so profuse as to cloud the view. Its use is contra-indicated in acute inflammation of the bladder, urethra or kidneys and inoperable conditions likely to be made worse by it. Tuberculous cystitis has increased in importance as examinations have been more carefully made. It is most important to make a distinction between chronic cystitis caused by pus microbes and that caused by tubercle bacilli. Many serious mistakes are made in the prognosis and treatment of cases not properly diagnosed. The existence of a chronic inflammation of the bladder, in the absence of tangible evidence of infection with gonorrhoea or colon bacillus, chronic urinary obstruction or infection from instrumentation, should always leave a suspicion of a tubercular condition. (Senn.)

**PROGNOSIS.**—The prognosis depends upon the predisposing cause and the type of infection. It is the colon bacillus which seems the most likely organism to invade the ureter and kidneys. Cure depends upon removing the predisposing cause, as stricture, enlarged prostate, stone, neoplasm, pyelitis, etc., and upon the extent of alterations in the bladder walls. In the majority of cases, if the primary cause is found and removed and the proper medication, diet and hygiene are carried out, a cure may be expected. The course of tubercular cystitis can be modified, the patient made more comfortable and life prolonged, but a complete cure rarely can be obtained. The importance of a correct diagnosis is evident before making a promise as to the probable results.

**TREATMENT.**—In acute cystitis the chief indications are rest in bed, light diet, bowels to be kept open and urine to be rendered bland and unirritating by copious draughts of water, milk, buttermilk, whey and lithia water. Hot fomentations to the pelvis or hot sitz baths lessen the congestion and relieve the pain. In women hot vaginal douches should be given once or twice daily. These, as a rule, are sufficient to make the patient comfortable; if not thus relieved, the following suppository may be given:

R	Morphine sulphate -----	.013	gr. 1-6
	Ext. hyocyam. a. a. -----	.016	gr. 1-4
	Cocoa butter -----	.8	grs. xii
M.	et ft. suppository No. 1.		

Sig.: One such introduced into the rectum every few hours as required to relieve the pain.

Hexamethylamine (urotropin, cystogen, hexamine, etc.) in 5 to 10 grain doses is a valuable remedy.

One or two ounces of a 3% solution of argyrol injected through the urethra into the bladder with a suitable syringe is probably better as a routine local application for both male and female than any other remedy. It is both soothing and germicidal in its action.

Irrigations should not be given in hyperacute cystitis, but may be used with decided benefit in the subsiding stage. The fluid should have about the same specific gravity as the urine. The following prescription has given very satisfactory results:

R	Boric acid		
	Borax a. a. -----	4.	3i
	Sodium chloride -----	2.	grs. xxx
M.			

Sig.: Dissolve in a quart of hot water and use as irrigation with a Valentine apparatus as previously described in male

patients or with a glass funnel attached to 6 feet of rubber tubing and connected with a glass catheter in women (or a soft rubber one in men if necessary).

**IRRIGATION WITH FUNNEL, TUBE AND CATHETER.**—The catheter, after thorough sterilization, is introduced, the funnel is lowered and the urine flows out and fills it. The tube is compressed and the urine replaced by the irrigating fluid which flows into the bladder when the funnel is raised. The bladder is thus washed by repeating this procedure until no shreds, pus or mucus can be seen in the irrigating fluid. These irrigations may be repeated once or twice daily, and argyrol solution allowed to flow into the bladder and so remain after the irrigations until the patient desires to urinate.

As the inflammation becomes chronic the irrigations should be made more stimulating, as mercuric bichloride 1-5000 to 1-2000 or nitrate of silver 1-8000 to 1-4000; weak solutions should be used in the beginning and the strength gradually increased as the bladder becomes tolerant.

Koll claims to have obtained unusually satisfactory results in bacillus coli infections of the urinary tract by the local use of aluminum acetate. He emphasizes that preparation is of great importance. The National Formulary should be followed very closely. After the full strength solution is prepared, he advises diluting each time the liquor employed because unless a very carefully distilled water is used carbonates of the water will throw down a heavy gelatinous precipitate of the aluminum hydroxid, which will leave free acetic acid. A second suggestion he makes is to start a 1 per cent. in severely inflamed bladders and in each case control the irritation with opium suppositories.

Vaccine therapy and phylacogen may give much assistance in the treatment of cystitis. (See chapter on this subject.)



If the cavity of the bladder is small, its capacity may be increased by overdistention with irrigations, or by the patient resolutely holding the urine until the bladder is somewhat dilated. These methods should never be employed in the tubercular cystitis. Balsam copabia and oil of sandalwood may be given in form 5 to 10 minim doses in chronic catarrhal cystitis.

Chronic ulcers may be touched, through a cystoscope, with nitrate of silver fused on a probe. Frequently a few such applications will be sufficient to cure.

If a calculus is present it can be crushed and removed through the urethra, or by cystotomy, as conditions indicate. Hypertrophy of the prostate and strictures should be treated according to the rules and principles described in the chapters dealing with these subjects.

THE TREATMENT OF TUBERCULOUS CYSTITIS is largely surgical to remove the tubercular kidney which is nearly always present and systemic to increase the vitality of the tissues. Tuberculin administered in small doses and with discrimination may do good. Tonics and laxatives should be administered as indicated; cod liver oil, change of climate, rich, nourishing food, plenty of fresh air, sunshine and regulated exercise may all be of service. Five to ten per cent. iodoform in an emulsion of olive oil injected into the bladder may be beneficial. The patient is instructed to watch the flow of urine and stop when the emulsion appears. Roving has adopted the use of 5% carbolic acid solution of which 50 c.c. are injected after the bladder has been washed free from pus and mucus. The fluid should be retained three to four minutes. A three-tenths grain morphine suppository is introduced to lessen the pain which occurs two or three hours after the injection. This is repeated every second day until the urine remains fairly clear between, and the interval is then gradually lengthened. Treatment has lasted from one to as much as six months. No result is to be expected from

this or any other treatment unless the diseased kidney is first removed.

**SUMMARY.**—Cystitis is caused by infection associated with traumatism, stagnant urine or some such predisposing factor, as urethral stricture, prostatic hypertrophy, etc. Tubercular cystitis is nearly always secondary to tuberculosis of one or both kidneys. The symptoms of cystitis are frequent and painful urination. These symptoms, however, may be caused by prostatitis, seminal vesiculitis or inflammation of the deep urethra. All the glasses of urine show pus in cystitis. To prove the diagnosis the other urinary organs must be excluded as sources of the pus. Many mistakes will be made in the prognosis and treatment unless the correct diagnosis is made and the predisposing factors determined by careful examinations and cystoscopic observations. The prognosis depends largely upon removing the predisposing causes.

In acute cystitis the treatment should include rest in bed, light diet, and the urine should be rendered bland by copious draughts of lithia water and milk. Hot sitz baths and hot fomentations to the pelvis will lessen the pain and frequency of urination.

Hexamethylamine should be given in 10 grain doses four times daily. Soothing irrigations of potassium permanganate in a physiologic salt solution, or boric acid irrigations may be administered once daily if the inflammation is not hyperacute. An injection of two ounces of a two per cent. solution of argyrol injected into the bladder when empty is often useful. Vaccine therapy is also of value. For chronic inflammation of the bladder we should eliminate the predisposing causes and administer irrigations and vaccines. (Study Treatment of Tuberculous Cystitis.)

## CHAPTER XXIII

## VESICAL CALCULUS

ETIOLOGY, PATHOLOGY, SYMPTOMS, DIAGNOSIS, TREATMENT,  
LITHOLAPAXY, AFTER TREATMENT, SUPRAPUBIC CYS-  
TOTOMY, PERINEAL CYSTOTOMY AND SUMMARY

**VESICAL CALCULUS.**—There are two main subdivisions of stones in the bladder, primary and secondary. The former originate in the kidney and descend into the bladder, while the latter are formed in the bladder from local conditions.

The primary are composed of uric acid, oxalate of lime, or xanthin and are found more frequently in patients who are high livers and have no obstruction of urine.

The secondary stones consist of ammonia-magnesium phosphate and carbonate of phosphate of lime. These occur in such conditions as stricture, hypertrophied prostate, from foreign bodies in the bladder, or where there is anything which causes bladder irritation, cystitis or urinary obstruction.

**ETIOLOGY.**—The origin of the primary calculus is not clearly understood. It seems there is a precipitation of salts from the urine in the presence of a colloid or mucous substance, but we cannot say why this occurs. Gout and rheumatism appear to be closely related to uric acid stones. Oxalate of lime stones are thought to be caused by eating large quantities of vegetables, such as tomatoes, asparagus, celery, and fruit, as apples and pears. Casper says they are common in poor children, while those composed of uric acid occur in rich old persons who are high livers. Race and heredity are prominently connected with the occurrence of primary calculi. The negro is

almost exempt on the one hand, while the natives of India and Egypt very frequently have cystic calculi. A sedentary life with excessive consumption of nitrogenous food and wines and liquors were thought to contribute to their formation. This view formerly undisputed is now thought to be incorrect, as the amount of uric acid and urates is relatively small, as shown by chemical analysis, when compared to the mineral constituents which are better held in solution in acid urine. Consequently, acid urine is thought to be less likely to permit the formation of stones and the diet should be requested accordingly.

Secondary stones depend upon the condition of the bladder, urinary obstruction, stagnation and decomposition of urine. Precipitated phosphates are caught in the mucus and form the nucleus, or perhaps a primary stone or some foreign substance may act in this capacity, and around it more of the salts collect. Changes in the chemical reaction and character of the urine cause different deposits so that the stone on section may have a laminated appearance.

Diverticuli of the bladder favor the occurrence of calculi on account of the stagnation and decomposition of urine within their cavities.

**PATHOLOGY.**—The size and number of stones vary greatly, as does their appearance. When many are present they have smooth surfaces, but if single they are usually round or oval. Those composed of urates have a yellowish red color and a granular surface. Oxalate of calcium stones look something like mulberries and are rough with irregular pointed projections. They are the hardest of the calculi. Phosphatic stones are usually multiple, have a light gray color and are soft and can be easily broken or powdered.

At first the stone itself produces very slight changes in the bladder except in predisposing to infection and the resulting inflammation. The cystitis may assume various degrees and

produce the different complications that are given in the chapter on this subject.

Trabeculations and projections from the mucous membrane may become encrusted with a calculous deposit.

**SYMPTOMS.**—There are three important symptoms of stone in the bladder, pain, hematuria and disturbance of micturition. Pain, the most constant of these, usually increases with the inflammation, and is worse during the day when the patient is walking around than at night when quiet in a horizontal position. The jolting from riding in a rough vehicle aggravates the pain. It is also generally worse just at the end of urination when the empty bladder contracts upon the stone. The pain is usually referred to the head of the penis or along the urethra, but may occur as dull aching in the perineum or it may radiate down the thighs. The pain is relieved when the bladder is full, while just the reverse is true in cystic tuberculosis.

Hemorrhage is not so profuse as in tumors and can usually be made to subside if the patient remains in bed. It may be present in the form of terminal hematuria, produced by the muscular contractions upon the stone. Casper lays great stress upon the presence of blood cells in the urine, even if their number is small and they are only demonstrable with the microscope. Urination is nearly always increased in frequency and sometimes the desire to urinate is most intense. Severe lancinating pains are occasionally felt when a small stone enters the deep urethra. Stoppage of the urinary stream during micturition is a rare symptom.

The urine, of course, after the inflammatory condition has been established, will have all the characteristics of that found in cystitis; with uric acid stones cystitis is likely to be slow in appearing.

DIAGNOSIS.—Where suspicion has been aroused by the foregoing symptoms, especially by pain which is worse during exercise and just at the end of urination, a cystoscopic examination should be made. In the majority of cases this readily enables one to make a positive diagnosis. It furnishes information as to size, number and location of the stones, whether or not they are encapsulated, and shows other pathological conditions that may co-exist.

When this is not feasible a stone searcher should be introduced into the empty or nearly empty bladder. The grating sound imparted by the contact of the instrument with the stone is not likely to be mistaken for anything else, but does not give the size or any other information concerning it as does the cystoscope, nor are negative examinations always to be relied upon. Stones are not infrequently inaccessible in the base of the bladder and are sometimes found behind a hypertrophied prostate or within a diverticulum or folds of the bladder, and in these situations they are easily overlooked. The searcher should be introduced as a sound would be and is gently moved back and forth while being rotated, so that its beak will be brought in contact with calculi lying on the floor of the bladder.

Where there is stricture of the urethra or hypertrophy of the prostate preventing the passage of suitable instruments, reliance, of course, must be placed in other measures, as rectal, vaginal and suprapubic palpation. The X-ray is of great value in the diagnosis, as it enables one to determine the size and location of stones, but it cannot be depended upon, when negative, as the stones composed of urates are the most frequent variety of primary calculi, and do not give a distinct shadow. No one method should be used exclusively, but our ingenuity should be exercised in studying the exact condition and the cause, and also which is primary, the stone or the cystitis.

**TREATMENT.**—Preventive treatment becomes largely one of proper diet, hygiene, exercise, bathing and clothing. The food should be of such a character as to render the urine acid and thus better keep in solution the mineral constituents which form the greater amount of nearly all stones. Free use of distilled water or plain water is of value in preventing the precipitation of the salts from the urine. Alcoholics, and especially sweet and heavy wines, should be prohibited. Tepid baths should be taken frequently and followed by brisk rubbing to stimulate the skin and promote its activity. Internal medication with drugs in attempting to dissolve a stone that has already formed is useless, as are local chemical means of dissolving calculi. For stones which are passing from the kidney into the bladder, causing severe ureteric colic, a few doses of two grammes (gtts. xxx) of chloroform in fifteen grammes (℥ss) of thick syrup washed down by a drink of water will often be quickly effective (Gouley); otherwise inhalations of chloroform may be given until relief is obtained. Morphine and atropin are also of value, but must be given guardedly, for if the doses are too large, poisoning may supervene upon the passage of the calculus. When disease of the kidneys or some grave intercurrent disease is present palliative measures are indicated. Among these may be mentioned rest, hypnotics, opiates, belladonna and bladder irrigations.

Palliative irrigations and argyrol injections into the bladder should be recommended until the patient can submit to the operation.

**LITHOLAPAXY.**—The crushing and removal of a stone in the bladder through the urethra is termed litholapaxy. This operation was first performed by Civiale, but never came into general use until Bigelow modified the operation by devising a suction apparatus for removing the fragments after the calculus had been crushed. It is the safest operation where there



Figure 68.  
Modified Bigelow  
Lithotrite.

is no contra-indication, such as an unusually large stone, a tight resilient stricture of the deep urethra or certain forms of prostatic hypertrophy. It is not advisable for children, although there are small lithotrites which make litholapaxy available to some extent here. The patient should be prepared for the operation by rest in bed for a few days and by the free use of diluent drinks and urinary antiseptics, especially urotropin. The same strict asepsis and antisepsis should be observed as in any major operation.

The patient is placed in a dorsal position and anesthetized, for it is unsafe to attempt it with local cocainization. The lithotrite should be perfectly made and previously tested as to its strength and reliability. The bladder should be washed out through a catheter with a boric solution and about 5 ounces of the fluid left in the bladder to distend it and prevent its folds being caught in the lithotrite. One or two sounds a few sizes larger than the crushing instrument should be passed in order to dilate the urethra. The canal should be filled with sterile olive oil to furnish thorough lubrication, the lithotrite gently introduced and then opened with the jaws of the instrument looking upward. It is then manipulated until the calculus is engaged within the jaws. After rotating the instrument to ascertain if the mucosa is free the jaws are screwed together and the stone crushed. The instrument is now removed, the evacuating catheter introduced and suction applied and continued as long as detritus can be withdrawn.



Further search should be made for fragments and any that are found should be crushed and washed out as above described, or by the evacuating lithotrite devised by Chismore especially for this purpose. Recently the lithotrite has been combined with the cystoscope so that one may grasp the stones with greater accuracy and recrush the large fragments. Before completing the operation the bladder and urethra should be washed out to remove any particles that may be caught in the canal. Finally the bladder should be filled with 1-1500 nitrate of silver solution.

**AFTER TREATMENT.**—As a rule, the patient should be kept quiet or in bed from two to three days and given liberal draughts of water. Free passage of urine should follow, and if it does not, a catheter should be fastened in the urethra for a few days or introduced as needed. To remove any remaining gravel, the evacuating pump should be used about 10 days after the operation, or earlier, if tenacious masses of mucus are present in the bladder causing tenesmus and a frequent desire to urinate.

Occasionally epididymitis, prostatitis, cystitis and urinary fever may occur as complications after litholapaxy.

**LITHO-CYSTOTOMY.**—From a review of the history of this operation Gouley had found that fourteen different modifications had been suggested.

**THE SUPRAPUBIC METHOD** was first done about 1560 by Pierre Franco on a boy two years of age, who survived the operation, but Franco himself condemned the operation, as did his contemporaries. The suprapubic operation has in recent years become more popular than is the perineal. Both have their indications, as has litholapaxy, and the method should be selected which seems best adapted to the peculiarities of each patient.

The patient should be placed in the Trendelenburg position and the bladder inflated with air or water to prevent injury to the peritoneum. A verticle incision is made just above the symphysis pubis, and unless the stone is very large, this opening will be sufficient; otherwise the transverse incision of van Antal may be used. The bladder is opened and a suture placed on each side to act as guy cords and to prevent the stripping of the

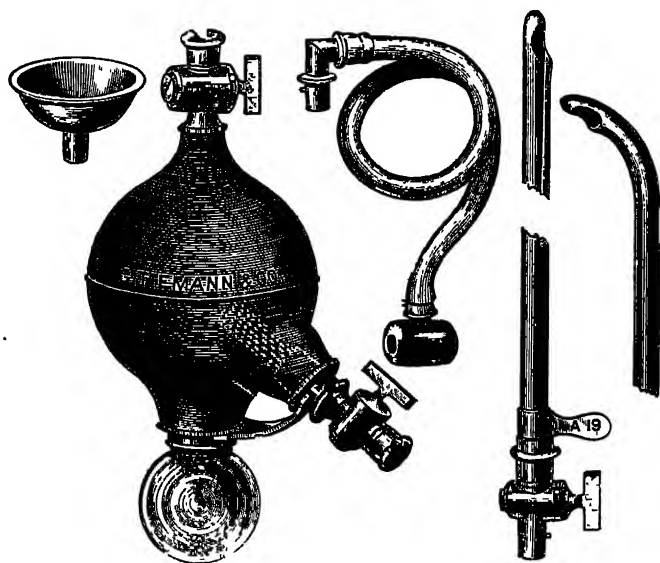


Figure 69.—Bigelow's latest evacuator.

bladder from the adjacent structures. The calculus is removed with stone forceps. If it is very large it should first be crushed with suitable instruments. All fragments should be thoroughly removed. The bladder should be drained with a good size rubber tube. The remainder of the incision is sutured. The tube should be removed in about a week. This method is best suited to conditions where there is cystitis and hypertrophy of the prostate, or stricture. In case the urine is free from pus and there is no obstruction to its free passage, the entire wound may be closed and a large catheter tied in the urethra. This method

should not be used where the bladder is infected or where traumatism has been necessary in removing the stone. If clots block the catheter they may be sucked out by means of a large (45) piston syringe.

**PERINEAL CYSTOTOMY FOR STONES.**—Only the median operation will be described. This route has a lower mortality than the suprapubic, and is indicated where the calculus is small and conditions contra-indicate litholapaxy.

The patient should be placed in a dorsal position with the limbs drawn well up and flexed. A grooved instrument is introduced into the bladder and the stone found. An assistant holds the guide in this position and makes slight traction on the penis and scrotum so as to pull the bulbous urethra forward and out of danger of its artery being cut, which would cause considerable hemorrhage. An incision is made in the mid-perineal region to within 3-4 of an inch of the rectum and deepened until the groove in the instrument within the urethra can be felt. The point of the knife is placed in the groove and pushed onward toward the bladder, cutting the floor of the urethra just in front of the prostate. The finger is introduced and the opening stretched. Stone forceps are then introduced and opened, and the calculus is caught and extracted, care being taken not to injure the membranous urethra in front with the danger of subsequent incontinence of urine, and not to make an opening into the rectum at the back with likelihood of a fistula. Hemorrhage may be considerable if the artery or the bulb or the prostatic plexus is incised. The hemorrhage should be controlled by ligating the larger vessels and by pressure. A convenient instrument for obtaining suitable pressure is the "cannula a chemise," which is a tube for the drainage of urine; around the proximal end is a ridge for a petticoat of sterile gauze under which more gauze is packed until the desired pressure has been procured. Buckstone Browne has invented a contriv-

ance for obtaining such pressure; it consists of a bag which is dilated with air under the gauze.

The wound is dressed with abundant gauze around a drainage tube. After removal of the tube the wound usually heals promptly. In both operations the bladder should be irrigated daily until the tube is removed.

**SUMMARY.**—Vesical stones may be primary or secondary. The origin of primary stones is not understood. Pain, hematuria and disturbance of micturition are the main symptoms of stone in the bladder. The pain is worse from jolting and exercise, and is generally worse at the end of urination. Hemorrhage is less profuse than in tumors of the bladder and usually subsides if the patient remains in bed. The stone may cause cystitis to develop with its symptoms and urinary characteristics.

The diagnosis can be readily made by cystoscopic examination, or less satisfactorily by the passage of a stone searcher into the empty or nearly empty bladder. The X-ray may be employed, but cannot be relied upon when negative. Preventive treatment is largely one of proper diet, hygiene, bathing and clothing, and drinking large quantities of distilled water. During the passage of the stone down the ureter into the bladder the excruciating pain should be mitigated by hot fomentations, morphine and chloroform inhalations.

Litholapaxy is the operation of crushing and removing stones through the urethra. It is the operation of choice if the urethral passage will admit the easy introduction of the lithotrite, otherwise the stone may be removed by a suprapubic or perineal incision.

## CHAPTER XXIV

## TUMORS OF THE BLADDER

CARCINOMA AND SARCOMA, SYMPTOMS OF VESICAL TUMORS, DIAGNOSIS, CYSTOSCOPY, TECHNIC, STERILIZATION OF INSTRUMENTS, TREATMENT OF TUMORS, OUIDIN CURRENT, SUMMARY.

Vesical neoplasms are comparatively rare; papilloma is the most frequent, and the base of the bladder is its favorite seat. The papilloma is usually a pediculated villous growth with the pedicle attached only to the mucosa and not surrounded by an indurated area. Another variety of papilloma may occur with a broad sessile base. Papillomata contain blood vessels in a stroma of connective tissue, all of which are covered by epithelium.

CARCINOMA OF THE BLADDER.—Carcinomata are either primary or secondary and the latter are much more frequently encountered, especially in women. Many different varieties of primary carcinomata are found, but cannot here be considered separately.

SARCOMA OF THE BLADDER.—This is rarely found, but may occur at any stage or in any portion of the bladder, and like sarcoma elsewhere has an infiltrated base.

SYMPTOMS OF VESICAL TUMORS.—HEMATURIA is the most frequent and most important of the symptoms. It occurs at some stage of nearly all vesical neoplasms and may be intermittent or continuous. The quantity of blood varies greatly, as does the time in which the bleeding occurs. The amount of

hemorrhage cannot be taken as an index of the size or variety of the tumor. Pain is a variable symptom and is dependent upon cystitis, involvement of the vesical neck in the growth, or



Figure 70.—Patient, operator, and tables in position for a cystoscopic examination. (Brown.)

upon the distention caused by the retention of urine. Tenesmus and retention may be caused by the blocking of the urethra with clots of blood, or by the tumor itself. The retention is, as a

rule, temporary, and is attended by a frequent and an urgent desire to urinate.

DIAGNOSIS.—Hemorrhage, perhaps profuse, without an assignable cause, with bladder irritation and the passage of the clots and fragments of neoplasm should lead to a thorough examination by palpation through the rectum or vagina, by sounding and with a cystoscope. Hemorrhage generally occurs more constantly in malignant tumors, but less profusely than in papilloma.

CYSTOSCOPY.—Nitz was the first to use cystoscopy successfully. Previous to his work the efforts at looking into the bladder were crude and of little practical value. After Edison discovered the incandescent lamp rapid development of cystoscopy followed. There are two main types of cystoscopes now on the market; direct and indirect. For general use and ureteral catheterization the indirect instrument is much more satisfactory than the direct, though the latter is sometimes necessary in diagnosis of bladder lesions. Few operative procedures require more constant practice and study than cystoscopy and ureteral catheterization. After once being mastered, however, there are a few things in genito-urinary surgery which afford more pleasure and satisfaction than does the use of the cystoscope. The accuracy it affords and additional information gained by its use make this branch of medicine and surgery second to none in scientific exactness. Persistent bladder and renal affections which suggest stone, tumor, sacculations, kinks in the ureters, beginning or well established hydronephrosis or pyonephrosis require cystoscopic examination, ureteral catheterization, pyelography, X-ray examinations, etc.

TECHNIC.—Unless one is familiar with the use of the cystoscope he should study well the mechanism of his instrument as well as its practical use on phantom bladders. Squier

suggests the use of a hollow rubber ball a little larger than a tennis ball, this is attached to a block of wood; openings are made to represent the urethra and ends of the ureters. By the study of such a phantom many points in the technic may be worked out.

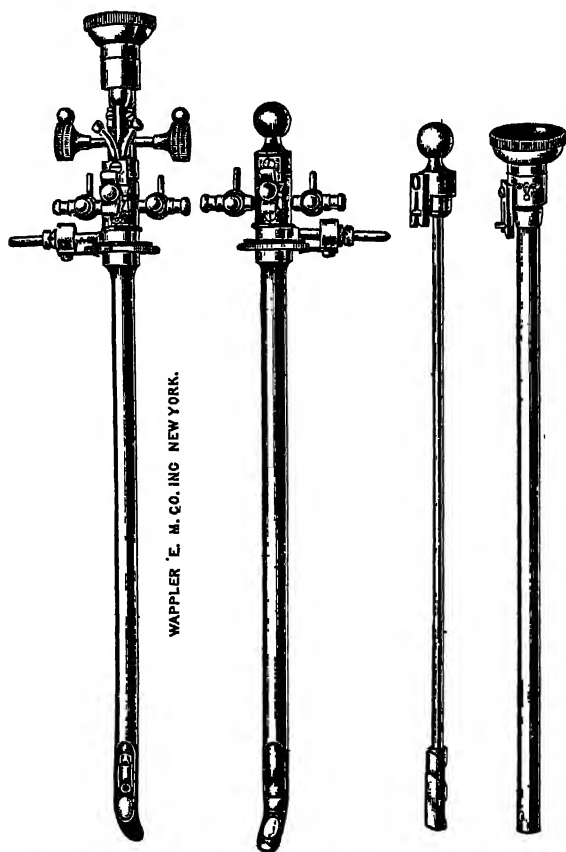


Figure 71.—Brown-Buerger combination cystoscope.

**STERILIZATION OF THE CYSTOSCOPE.**—All parts of the cystoscope and attachments used must be thoroughly sterile, all metal and rubber instruments or parts are thoroughly cleansed mechanically with soap and water, great care being taken to remove all foreign material. Rubber catheters and hollow in-



struments should have water under pressure forced through their lumen. The small tubes for carrying and guiding the catheters may be cleansed by using ordinary pipe cleaners.

The lens system and sheath should be thoroughly cleansed with soap and water, using a stiff brush, and washed with 5% solution of carbolic acid. All inclosed tubes should be injected with 5% carbolic acid solution or 10% formalin solution, followed by alcohol.

All, inside and outside, should be thoroughly dried.

With all the parts separated, they should be placed in a formalin sterilizer and be exposed to the heated formalin vapor for two hours, and be allowed to remain in the sterilizer until used.

For sterilizing quickly for a succession of usages:

Scrub thoroughly with soap and water inside and out. All metal parts, excepting those containing the lens system and lamp, should be boiled three minutes.

The telescope containing the lens system should be immersed in 5% carbolic acid solution for ten minutes and then in 95% alcohol for one minute.

The sheath containing the lighting system may be immersed in 95% carbolic solution for one or two minutes and washed off in sterile water before.

POSITION.—The patient is placed in a semi-sitting posture with the hips near the end of the table and the thighs fixed on the trunk and held in "rests" attached to the table. The trousers and drawers of male patients should be removed; the penis, pubic region and scrotum should be well scrubbed, then surrounded with the sterile sheets and towels. The urethra should be filled with a cocainized tragacanth lubricant, which should be pressed into the deep urethra. The light should be carefully examined to see that it is working properly. The cystoscope is then introduced just as a sound would be. The obturator is

removed and the bladder is irrigated with warm sterile boric acid solution until it returns clear. A specimen of the urine

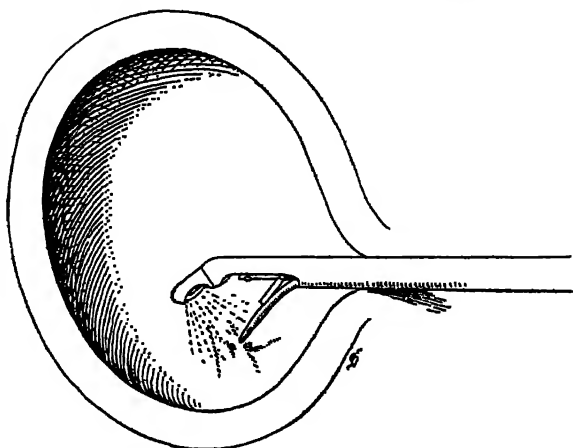


Figure 72.—Ureteral catheterization. (Buerger.)

voided before the operation is begun should always be preserved for comparison with specimens that may be secured



Figure 73.—Congenital diverticulum with normal ureter opening. (Pilcher.)

with blood, which of course may be traumatic. The desired telescope with or without the ureteral catheters is then inserted

and 180 to 240 c.c. (6 to 8 ounces) of boric acid solution is injected through the irrigating cock. With the light turned on we now begin the examination. Naturally one must be familiar with the appearance of the normal bladder before pathologic conditions can be recognized. It should be remembered that with the indirect cystoscope the picture as seen is inverted, unless a correcting lens is provided. One should try as early as possible to get his bearings by finding some point as the vesical sphincter, ureteral opening, or the bubble of air in the dome of the bladder. As the instrument is withdrawn a dark red area is seen; this is the neck of the bladder. By advancing, rotating, elevating and depressing the cystoscope the entire bladder wall may be viewed. The ureteral openings appear as two small slits on each side and are seen when the cystoscope is rotated about 30 degrees. It is in the trigone that we usually find the most important things, such as stones, ulcers and tumors. The character of the mucous membrane around the ureteral openings often gives a clue as to the probable lesion. Tuberculosis of the bladder or the reddened ureteral orifice, with tubercles or ulcerations, presents a striking and diagnostic picture. Trabeculations of the bladder wall may be recognized, as also sacculations. Tumors of the bladder may be readily seen. Blood clots and mucus may be mistaken for such tumors as papillomata. Foreign bodies will occasionally be seen.

**PROGNOSIS.**—Benign growths may exist for years without causing death unless complications arise or severe hemorrhage occurs, as frequently is the case with papilloma. Carcinoma is fatal within six months to two years, and it is always worse when at the neck of the bladder. The same may be said of sarcoma.

**TREATMENT OF TUMORS OF THE BLADDER.**—Benign tumors of the bladder should be approached from the inside with

the high frequency current, while malignant growths should be excised by the transvesical or transperitoneal route if the patient's condition will permit such an operation.

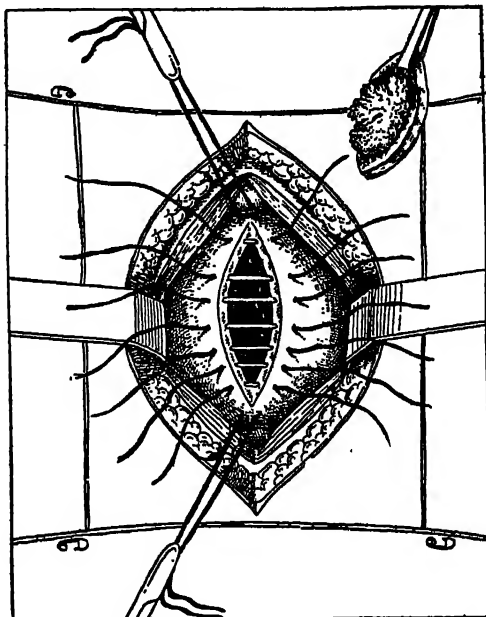


Figure 74.—Partial cystectomy. Section of the bladder wall with the tumor removed by two elliptical incisions. This can be either extra or intraperitoneal. In this figure it is extraperitoneal.

THE OUDIN HIGH-FREQUENCY CURRENT IN THE TREATMENT OF PAPILLOMATA OF THE BLADDER.—In 1910 Beer called attention to his success in the treatment of benign tumors of the bladder with the high-frequency current. Since that time he and many others have corroborated his claims. Now this method is generally admitted to be the method of choice in dealing with papillary growths of the bladder on account of its simplicity and effectiveness. It consists in the application of the high-frequency current through a heavily insulated copper electrode under water. The current has been used for many years in the treatment of surface growths, but Beer was the first

adopt this method of attacking benign bladder tumors. Malignant growths are not usually amenable to this treatment; therefore, an early diagnosis is most important. Where the patient's health will not permit of operative measures, Beer thinks the best palliative measure is the high-frequency current, which may effect a cure occasionally, even when the growth is malignant.

Papillomata show a great tendency to return after the transvesical or the transperitoneal route so strongly recommended by Dr. Charles Mayo.

The trans-urethral route of removing benign tumors of the bladder has many technical difficulties. Beer's method is simpler and appears to give better results than the operating cystoscope. He gives the following description of his method: "The essential instruments for this therapy are: (1) a high frequency machine with Oudin resonator; (2) a catheterizing cystoscope; (3) a heavily insulated copper electrode. After the bladder has been washed and then filled with distilled water, the cystoscope armed with the electrode is introduced. The electrode is pushed a short distance in amongst the villi and the current is allowed to play for 15-30 seconds at each application. The nearer the electrode approaches the base of the growth the shorter should be the applications, lest the bladder wall be injured. Moreover, if the electrode touches the bladder wall it causes pain, otherwise there is no pain. By making repeated applications at different spots the whole growth will be rapidly destroyed, and as it disintegrates it is voided in small pieces, as a rule. This process of separation in very large growths may extend over several months. As stated, I employed the Oudin current derived from a Wappler machine, usually placing the rheostat vertically, so that half the resistance was thrown to the circuit. If a stronger current seemed necessary I v out the rheostat altogether. The spark gap in the muffler made between one-eighth and one-quarter inch. Usually

I employed a short gap. As a rule, I employed the Nitze double catheter cystoscope. In one catheter tunnel I placed the electrode and to the other I attached a tube for irrigation. A direct cystoscope is useful in some cases, in others absolutely necessary. The electrode employed was a simple 61-ply copper wire thoroughly insulated and cut off squarely at the end. The end has to be pruned repeatedly as the rubber insulation melts during usage. This electrode I procured through the Wappler firm.

"APPLICATIONS.—The applications were made directly to the growth, the electrode being pushed a short distance in among the villi under the guidance of the eye, and then the current was turned on at various points for 15-30 seconds, the bladder being distended with distilled water. In my early seances I made the treatments rather short. The longest total applications that I have used at one seance aggregated 10 minutes 30 seconds at 20 different spots. This was an enormous tumor and so long an application surely is not necessary except in such cases. A total of 3-5 minutes at one sitting will suffice usually. A few days later it should be repeated, provided any viable tumor tissue is visible, as at the original sitting it is impossible to determine how extensively one has destroyed the growth. Treatments are discontinued as soon as the whole growth appears necrotic. The sloughs are allowed to separate spontaneously or helped along with bladder irrigations. After the base is thus exposed (after 3 weeks or longer) it is treated as were the original outgrowths.

"EFFECTS.—The immediate visible effects are very striking. No spark is seen if the electrode is placed properly among the villi. A spark may be seen if the surface is flat and prevents the electrode from burying itself. While the current is on, gas is freely generated and bubbles out of the growth. If

the point of application is superficial, one can readily see blanching of the tissues about the point of application, and at the spot where the electrode's point rested the tissues are blackened. As the electrode is withdrawn from the growth, very frequently it is found to be adherent to the villi, and as it is pulled upon, the whole tumor moves with the electrode, which finally comes away with a small mass of tumor tissue baked to its tip. This is only rarely followed by bleeding, and a re-application of the current at the same spot usually controls this. After the patient has expelled the necrotic tumor the base may require further brief applications to destroy any tumor residue as stated above. The patients should be carefully cystoscoped from time to time, and if any suspicious areas are visible they should be destroyed at the same sitting. In this way we can hope to obtain excellent and permanent results.

"DANGER.—No method which is so destructive of tumor tissue can be absolutely free from danger. The patient that died some four days after treatment may have died of an embolus, and this possibility, I suppose, should be borne in mind, irrespective of whether death in this particular case was due to this cause or not. This is, however, a remote danger, judging from all experiences with this method up to date.

"Another danger that one can imagine is severe burning or perhaps perforation of the bladder wall. With care this should be avoided. As one is working under the guidance of the eye, one ought to know exactly where the electrode is situated before turning on the current and by adhering to this fundamental point no such damage should be inflicted."

EXSECTION OF MALIGNANT TUMORS.—The advisability of operating to remove a cancer of the bladder depends upon the likelihood or actual existence of metastas. If the tumor of the bladder is secondary to cancer of the prostate, cervix, womb,

or other organs, operative measures depend upon removal of all cancerous tissue otherwise palliative treatment should be recommended.

The suprapubic incision is made as as previously described under prostatectomy. The prevesical fat and peritoneum are carefully separated so as to expose well the anterior part of the bladder and all of its surface overlying the tumor so that the line of incision may be carried through healthy tissue. Guy sutures are then placed in the bladder so as to pull it to the side and obtain access to the tumor. Schmidt advises that the prevesical fat be sutured back so as to form a protection against infection of the peritoneum. The tumor is then excised with the entire thickness of the bladder wall. The bladder is then closed and the prevesical space drained with a Penrose cover and gauze. A permanent catheter should be placed in the urethra and the bladder frequently irrigated, as after prostatectomy.

**SUMMARY.**—Papillomata are the most frequent tumors of the bladder. They show both a tendency to recur and to become malignant. The symptoms are hematuria, pain, tenesmus, and retention of urine by the blocking of the urethra with blood clots or the tumor itself. The diagnosis should be made by cystoscopic examination.

**CYSTOSCOPY.**—There are two main varieties of cystoscopy: (1) those affording a direct view of the bladder wall, and (2) those giving an indirect view by means of prisms. Cystoscopy requires: (1) that the urethra must admit the introduction of the cystoscope without severe hemorrhage; (2) that the bladder hold at least 90 to 150 c.c. (3 to 5 ounces) of fluid; (3) that the fluid remain clear. Success, furthermore, depends upon the skill and experience of the cystoscopist. The patient should be placed on a suitable table in a semisitting lithotomy position.



A sterile technic should be carried out in every detail. The urethra should be cocainized and lubricated, the instrument introduced, the bladder irrigated with a boric acid solution until it returns clear; the proper telescope is inserted before 180 to 240 c.c. (6 to 8 ounces) of boric acid solution have been injected into the bladder, the light (which has been previously tested) is turned on and the examination made.

THE TREATMENT OF TUMORS OF THE BLADDER, if benign, should be with high-frequency current applied through the cystoscope. If malignant and limited to the bladder the tumor should be excised. If malignant but the patient cannot withstand an operation, palliative treatment with the high-frequency current should be recommended and may at times effect a cure. (Beer).

## CHAPTER XXV

## DISEASES OF THE KIDNEYS

FISCHER'S THEORY AS TO THE CAUSE OF NEPHRITIS, ACUTE  
BRIGHT'S DISEASE, CHRONIC BRIGHT'S DISEASE, SIGNIF-  
ICANCE OF ALBUMINURIA, SUMMARY

GENERAL CONSIDERATIONS.—The recognition of renal affections is exceedingly important and very difficult in many incipient pathologic conditions, when treatment or prophylactic measures would be of most value. The uncertainty that surrounds the diagnosis renders it useless to enter into a discussion of the finer subdivisions of the pathology. Generally speaking, we recognize a parenchymatous nephritis which has its origin in the epithelial cells lining the kidney tubules, and an interstitial form, in which the connective tissue is chiefly affected. In neither of these forms, however, is the process limited altogether to one part of the kidney, the lesion always being more or less diffuse. Casper claims that the most that can be said in regard to the matter is that, according to the nature of the irritating substance producing the inflammation, the parenchyma will be affected in one case and the interstitial tissue containing the blood vessels in another; and it can only be determined that this or that tissue is preponderantly affected, and not that one is exclusively involved. Weigert has shown that renal inflammation is always diffuse.

THE ETIOLOGY OF NEPHRITIS.—The cause of nephritis has not yet been settled. A new theory advanced by Martin H. Fischer is based upon the study of colloids and their behavior under different experimental conditions, comparable to those under which the kidneys functionate both in health and disease.

Fischer believes that the colloids involved in nephritis consist of the blood which is essentially a suspension of colloids in which are floating fairly solid jelly-like structures or cells; of the "urinary membrane," which includes all the structures that lie in the kidney between the blood on one side and the urine on the other, and of the urine, which normally is a solution of salts and is not colloid in nature but whose colloid content rises in nephritis. Albuminuria, that chief urinary change in nephritis, has always been held to be due to the escape of the albumin of the blood through the diseased kidney, or, as Fischer calls it, "the urinary membrane." To him, however, albuminuria is something quite independent of the blood; the albumin is derived not from that tissue but from the kidney itself, whenever circumstances arise that favor the transition of the gelatinous colloids of that organ to the soluble state in which albumin is found in the urine. These circumstances may arise in different ways, but their chief mark is the fact that they produce an increased amount of acid in the kidney and thus favor the solution of colloids. This production of acid, Fischer reasons, is the chief cause of nephritis, the cause of albuminuria, the cause of the morphological changes in the kidney, the cause of the production of casts, of the variations in the amount of urine, and of the dissolved substances secreted by the kidney. While the normal kidney is not acid in reaction, its substance in nephritis, as shown by micro-chemical methods, becomes acid, and takes up corresponding dyes. Sections of freshly excised kidney take up such stains but very slowly, and very slowly give up albumin to the solution in which they are immersed. But let trace of acid be added and all parts of the kidney become deeply stained, and the albumin content of the surrounding fluid is quickly increased.

The morphological changes in the nephritic kidney are likewise explained by the accumulation of acid; it leads to the absorption of water by the individual cells, to the "edema"

them, and a consequent increase in the size of the kidney; it produces changes in its colloids and consequent "cloudy swelling" of the cells; it leads to the filling of the uriniferous tubules by the dissolved colloids and the consequent appearance of casts in the urine. Only subsequently the damaged tissues are replaced by connective tissue which slowly takes up the space of the parenchymatous cells, slowly contracts and leads to the

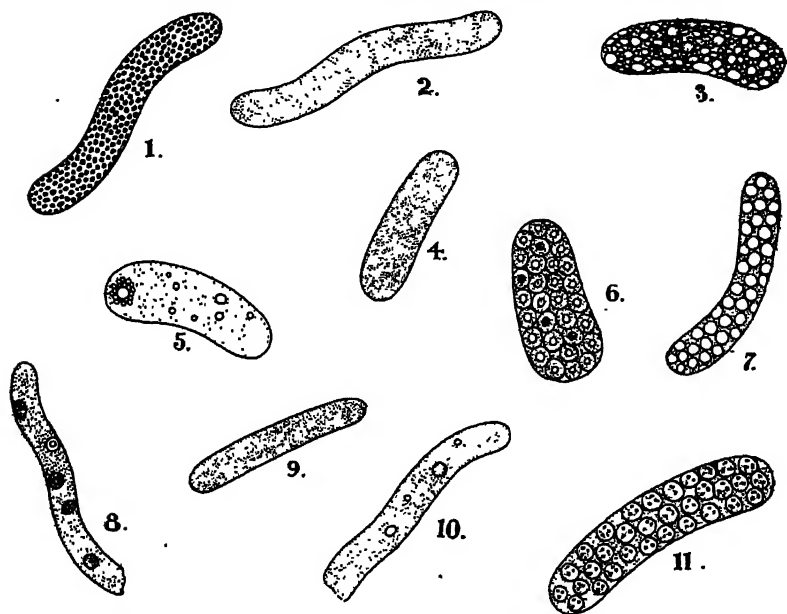


Figure 75.—Casts: 1. Coarsely Granular; 2. Finely Granular; 3. Fatty; 4. Finely Granular; 5. Finely Granular; 6. Epithelial Cast; 7. Blood Cast; 8. Granular Cast with Renal Cells; 9. Finely Granular Cast; 10. Finely Granular Cast with Blood Cells; 11. Pus Cast.

appearance of the later stage of the nephritic kidney, namely, the small or atrophied organ.

Experiments and clinical observations apparently bear out Fischer's theory and make it seem sound. Certainly it is plausible. The practical point about treatment of the edema is intravenous or rectal administration of solutions of carbonate of soda and sodium chloride. While our experience with Fischer's

theory has been too limited to permit a definite opinion, we have already been convinced that at least in part his theory is right. While we cannot subscribe to all of his ideas, his book is a masterpiece of logic and we heartily commend it to all who are interested in this important subject. The application of his theory has afforded us some striking results and we believe his treatment will have a well defined place in the therapeutics of non-inflammatory renal diseases.

Fischer's treatment consists in decreasing the acidity of the body by the administration of alkalis (chiefly carbonate of soda) and sodium chloride by mouth, by rectum, by intravenous injection or subcutaneously, according to the character and stage of the disease and the exigencies of the case. We have combined carbonate of soda with about one-half its weight of mutton suet, and one-fourth paraffin. While melted this mixture is placed in 00 capsules. Five may be given daily without producing gastric disturbance. One  $\frac{1}{4}$  gr. of phenol-sulphone-phthalein added to each capsule affords a good indicator to show the patient by the pink or red color of the urine when sufficient alkali is being taken. Carbonate of soda, 1 to  $\frac{1}{2}$  per cent. solution, may also be administered as a rectal injection in a 1 per cent. sodium chloride solution. The solution should be allowed to flow very slowly into the bowel. The amount varies from  $\frac{1}{2}$  liter (1 pint) to 1 liter (1 quart) or more two to four times daily; later substituting the internal administration. For urgent conditions, such as acute suppression, partial or complete, 1% solution of carbonate of soda in physiologic salt solution should be given intravenously by the method suggested for the injection of salvarsan. Needless to say every part of the technic should be perfect as regards the sterility of the solution to be injected. The physiologic salt solution should be freshly prepared and previously sterilized, the crystals of carbonate of soda (not the powdered) should then be added. The amount to be administered varies with the conditions to be

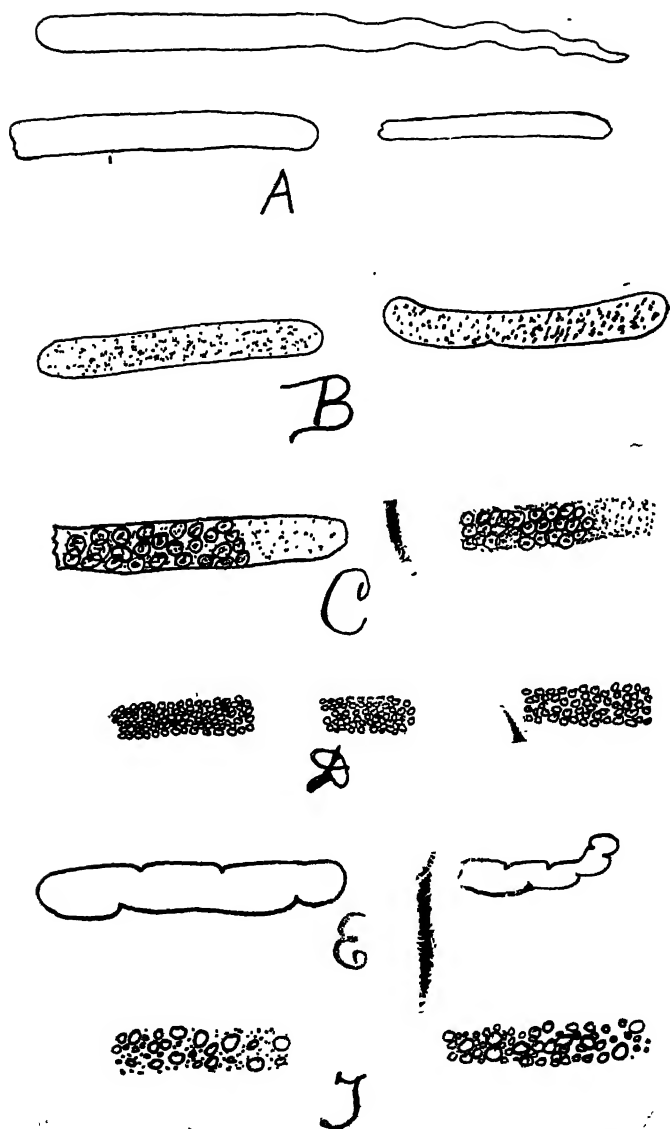


Figure 76.—Tube casts. A, Cylindroid and hyaline casts; B, Granular casts; C, Epithelial casts; D, Blood casts; E, Waxy casts; F, Fatty casts.

met, but  $\frac{1}{2}$  liter may be considered a medium dose for an average patient. The diet should be reduced so as to exclude the food which increases the acidity.

**ACUTE BRIGHT'S DISEASE.**—The cause of acute Bright's disease is an excessive and rapid production of an irritant, noxious substance in the circulating blood (Fischer says acid), which produces irritation of the kidneys in being eliminated. These irritants may be metabolic, toxemic, chemical or bacterial. Sudden hyperemic conditions of the kidneys, brought on by cold, heat, and mental or physical strain, may cause acute nephritis, but usually these are auxiliary rather than primary factors. Such diseases as scarlet fever, diphtheria, septicemia, and less frequently, pneumonia, erysipelas and typhoid fever produce acute renal inflammation.

**THE PATHOLOGY OF ACUTE NEPHRITIS.**—There is an intense hyperemia, followed by cellular exudation, especially around the small blood vessels in the cortex. Serum exudes in abundance, the epithelial cells undergo more or less degeneration and desquamation and are washed out free in the urine or as casts.

The size of the kidney usually is increased, its surface is smooth, the color varies from a pale red to a dark red with darker spots here and there due to hemorrhages, the tissues are soft and fragile, and the glomeruli appear as red granules. Although there is an intense inflammation, certain portions of the organ may be more intensely involved than others.

**SYMPTOMS.**—The onset is sudden and the patient suffers with general weakness, loss of appetite, headache, nausea, vomiting, edema of the ankles and wrists, and perhaps ascites. It may begin with a chill and may be followed by fever, but it is of great importance to remember that it often exists without

fever. The pulse is rapid and full. The urine is scanty, or entirely suppressed; it has a dark, muddy appearance from the presence of blood, casts and cells. The specific gravity is high on account of the small quantity secreted, and the total amount of solids eliminated in twenty-four hours is diminished, although the percentage may be about normal. Albumin is usually present in large quantities. Mania, uremia and convulsions may develop and pass into coma. Pain in the back may be severe, and may be attributed to other causes until after the urinary examination. The microscope will show red blood cells, leucocytes, renal cells and casts of all kinds.

PROGNOSIS.—The outlook is usually good, but if acute nephritis is slow in clearing up, chronic nephritis may follow.

TREATMENT.—Each patient must be treated according to his or her individual needs; therefore no rigid rules can be adopted. Fischer's treatment with carbonate of soda or acetate of potash should be administered according to the urgency of the symptoms to be combated. Rest, both physical and mental, is of utmost importance. The patient should be confined to bed in a quiet room of uniform temperature and free from drafts. The mind should be relieved, if possible, of business, professional and social duties.

To lessen the work upon the kidneys the diet should be restricted temporarily to a quart or a quart and a half of peptonized or plain milk daily. Cereal gruels may be added, and as the patient improves, a little meat, red or white, may be given; it is the quantity, not the quality, that must be feared. Meat extractives are said to be particularly harmful. While convalescing, the patient may be given green vegetables, bread and butter and eggs.

There is little agreement among writers upon the amount of water to be drunk, some claiming that a large amount dilutes



the poison, promotes activity of the excretory organs, and is beneficial; others assert that it overtaxes the kidneys at a critical time, and adds to the edema. Green and Brooks prescribe water in excess only in those cases in which edema is not present and in which the toxic symptoms dominate the disease picture. Opponents of the Fischer theory urge that the amount of sodium chloride should be restricted, as it adds work for the kidneys and increases the edema. This view was advanced long before Fischer presented his theory and at times seems to be substantiated by the results.

Diaphoresis should be stimulated by the use of the hot pack or by the employment of dry heat, and the bowels should be moved freely with calomel, magnesium sulphate, jalap or elaterium. The heart should be watched and aconite or digitalis administered as the symptoms indicate. Severe pain over the kidneys may be relieved by dry cupping and by the administration of small doses of morphine or acetanilid.

THE SIGNIFICANCE OF SLIGHT ALBUMINURIA.—Slight albuminuria and its bearing upon the diagnosis in obscure chronic conditions is of much importance and, therefore, will be discussed at some length. The writer has often asserted to his students that he would prefer that they should not know how to make the test for albumin, rather than, knowing this, be unable to conceive of its arising from any cause except Bright's disease. Much harm and unnecessary anxiety may be caused by a physician who lacks the power to discriminate as to the various sources and the significance of the different forms of proteid in the urine. It is doubtful if many will read this who cannot recall the history of an albuminuric friend or patient who had been declared by a physician to be suffering from

nephritis and yet who, in spite of the anxiety produced by such diagnosis and prognosis, may have lived for years, free from any other evidence of kidney disease than the slight albuminuria; and that perhaps even the albumin disappeared in time.

When Richard Bright called attention to the significance of albumin in the urine the less accurate methods first used in testing for albumin prevented the detection of those small quantities of proteid which we now find so frequently and have so much difficulty in correctly interpreting. Hasting and Hoobler have made a large number of examinations, and have found that the cases of undoubted Bright's disease, in which the symptoms and physical signs pointed to a renal lesion, include only 12.59 per cent. of the patients with albuminuria. Nucleo-albumin was frequently found, and should always be differentiated from serum-albumin.

Albumin in urine may be renal or extra-renal in origin. By renal we mean that it passes through the kidneys with the urine, and may be either due to a local lesion in the kidney or to a systemic condition which, by general changes throughout the body, or by toxins circulating in the blood or acids, injures to some extent the renal structure and allows the passage of albumin with the urine. Extra-renal albumin may come from any part of the genito-urinary tract below the kidneys, and is a contamination of the urine with proteid substances for which we should be constantly on the alert.

**SERUM-ALBUMIN, SERUM-GLOBULIN AND NUCLEO-ALBUMIN.**—The commoner proteid substances that are found in the urine are serum-albumin, serum-globulin, nucleo-albumin and albumose. Serum-albumin is the most important of these as a positive finding, and suitable tests should be made to eliminate the other proteids. Cohnheim's method (salting the urine with a saturated solution of sodium chloride, overacidula-

tion with three to five drops of 50 per cent. acetic acid and boiling), will throw down the proteids commonly found in the urine. Nucleo-albumin is not precipitated by heating in highly salted urine; consequently, a cloudiness with this test usually means serum-albumin. (Hasting.)

ALBUMOSE frequently has its origin in an inflamed prostate gland or seminal vesicle. The proteid substances that are secreted in the prostatic discharge are digested by a bacterial ferment or a ferment called leuco-protease, which is liberated from the disintegrating pus cells and only acts in a faintly alkaline medium. (Opie and Barker.) This albumose is not precipitated by boiling, nor does it give cloudiness at about 60 degrees C, as does Bence Jones' albumose. When precipitated with cold picric and citric acid, a sediment is formed, which disappears when heated, but again returns when allowed to cool.

Bence Jones' albumose gives a cloudiness below the boiling point, but clears when further heated. If stratified upon hydrochloric acid it will also cause the appearance of a white ring at the zone of contact. The other proteids do not react to this test. (Bradshaw.)

The acid secretion in the vagina prevents the digestive action of the leuco-protease which is liberated from the pus cells, and the proteid discharge is not changed into albumose, but may be converted into an acid albuminate which cannot be detected by the ordinary heat-test, but when precipitated will not clear up again, as does albumose when re-heated.

A prostatic abscess, draining into the urethra, will give large quantities of serum-albumin and globulin at first, and later, albumose. The presence of pus and albumin in such quantities at once suggests an abscess of the kidneys. We have previously reported the history of a patient with insidious prostatic abscess with urine exactly simulating a renal abscess.

ORTHOSTATIC ALBUMINURIA—Having found that we are dealing with albumin from the kidney, an even more difficult task is to determine its significance. It may be orthostatic in variety, as described by Stirling in 1887, under the name of postural albuminuria; because it appears only when the patient assumes an upright position. This form of albuminuria may or may not be attended with the tube casts and may or may not be followed by serious kidney disease. As a rule, however, it is the least harmful form of albuminuria and a rather common one. It is known that more urea is eliminated when the patient is in an upright position, and that the urine has a higher specific gravity and is more highly colored than when reclining. Why this should be the case we are unable to say. It has been assumed that the escape of albumin from the kidneys, when the patient is standing, is due to certain changes in the blood pressure or to paresis of the vaso-motor system of the kidney. Stirling showed that blowing wind instruments has a powerful effect in producing albuminuria; later, this observation was confirmed by Granger Stewart and others.

The experiments of Lemoisser have shown that standing lowers the secretion of water by the kidneys in all individuals, but this diminution of water was found to be greater in those in whom the kidneys were diseased, and the difference was sufficiently marked and constant to indicate that orthostatic oliguria is a very delicate sign of renal secretion. Concerning an increase in the albumin in urine of patients with an undoubted nephritis when they assume an upright position, very little has been written, but from a consideration of the facts pertaining to orthostatic albuminuria, we feel confident that such conditions exist.

Simidar made a number of experiments on animals, and found that physiological albuminuria occurs in them as well as in man.

Heubner has reported the post-mortem findings of a child in whom orthostatic albuminuria had been observed for a year and a half previous to death, which was caused by a brain tumor. The kidneys were found practically normal, the very slight changes being too trivial to be mentioned, and these changes were thought to be due to the long death agony.

Examples of orthostatic albuminuria have been found to precede certain well recognized forms of nephritis, and albuminuria in convalescents from scarlet fever has finally changed to the orthostatic form.

Bruas has reported the history of a case with intermittent orthostatic albuminuria during attacks of malaria. This observer was unable to say that malaria was the cause of the albuminuria, but asserted that it was undoubtedly a factor in producing it. In this connection we desire to report the history of a patient with syphilis, in whom orthostatic albuminuria was strikingly demonstrated. There were a few mucous patches in his mouth, and he suffered with severe nocturnal headache. Syphilis had been contracted ten months previously and had received very little attention. How long the albuminuria had existed we are unable to say. There were a few hyaline and granular casts. Under anti-syphilitic treatment, with iodide of potash and intramuscular injections of salicylate of mercury, the headache ceased immediately, the mucous patches were well in a week, and the urine became practically normal in a month, but the albumin showed a tendency to recur at intervals during the next two months. The casts also disappeared entirely. No etiological factor, other than syphilis, could be assigned as the cause of this patient's orthostatic albuminuria, and this view seems confirmed by the fact that under treatment of this disease the albuminuria cleared up with the obvious syphilitic symptoms and again returned after the patient had

discontinued treatment for four months. It is our opinion that if left untreated, this condition would have developed into a true syphilitic nephritis.

Tunis wrote letters to a number of the leading men of this country for their opinion regarding the significance of small quantities of albumin in the urine and, judging from their replies and from his own experience, he reached the conclusion that the mortality must necessarily be higher in those individuals who show this abnormality.

CASTS have about the same significance as has renal albumin. There are many drugs that cause their appearance, especially the hyaline variety. Severe muscular exertion and overindulgence in certain forms of food and alcoholics also produce them, where there is no nephritis. Merely their presence in a single specimen of urine, which has been allowed to stand, the upper portion decanted off and the lower part carefully centrifuged, cannot be taken alone as evidence of Bright's disease, even if a few granular casts are found. When irritated, the non-nephritic kidney seems capable of producing casts in larger numbers than can the diseased kidney, especially in cases of interstitial nephritis in patients of advanced age. (Emerson.)

In doubtful cases no positive opinion should be expressed until many specimens of urine have been examined, for the persistence of renal albumin and casts is of more serious import than is their occasional presence in much larger quantities. The twenty-four hour specimen should be measured and a comparison should be made between the quantity ordinarily passed and the quantity passed when an excess of water is being taken. The reaction is of importance, the alkaline treatment frequently causing the albumin to disappear. In addition the condition of the heart, the blood vessels, arterial tension, diet,

intestinal canal, habits, and past history should receive due attention.

Many patients with orthostatic albuminuria will go for years without any evidence of nephritis, but our prognosis must not be made from the urine alone, but from the entire clinical picture, including the phthalein test. Prudence demands that we be conservative, and yet not too pessimistic. Success in discriminating between the insignificant forms of albuminuria and those indicating renal disease depends more upon eliminating nucleo-albumin, extra-renal albumin and albumose than upon any further refinement in our chemical examinations.

#### CHRONIC BRIGHT'S DISEASE, OR DIFFUSE NEPHRITIS.—

This form of renal disease may follow acute nephritis, especially in those cases of acute nephritis caused by scarlet fever, erysipelas, pneumonia, and some of the acute infectious fevers, and we cannot say in such cases where the acute ends and the chronic begins.

**ETIOLOGY.**—The causes mentioned under acute nephritis, if mild and long continued, may induce chronic nephritis. Fischer thinks a too acid condition in the kidney may produce chronic nephritis. The improvement which sometimes follows the alkaline treatment lends weight to his theory. Noxious substances, no matter from what source, are eliminated by the kidneys. The mode of action of many of the factors which are associated in the production of chronic Bright's disease, such as mental strain, worry, overwork, and the so-called "strenuous life" are not clearly understood.

Overeating is a potent cause of chronic nephritis, but is more amenable to explanation, seeing that it throws overwork on the kidneys and increases the acidity. Alcohol is con-

sidered by some observers as a direct cause, but this has never been proven conclusively, and others claim that the harm comes rather from the overeating of the alcoholic than from the irritating influence of the alcohol itself. Diabetes mellitus is frequently associated with nephritis. The chronic contracted kidney is also sometimes caused by lead poisoning. We are unable in a certain number of cases to discover any condition that may be assigned as a cause of the disease.

THE SYMPTOMS AND DIAGNOSIS.—The symptoms of chronic diffuse nephritis are not characteristic early in the course of the disease; and we no longer think that albuminuria and casts always indicate beginning Bright's disease. The diminution in the excretive power of the kidney cells, which allows the accumulation of injurious substances in the blood, places more work on the heart, since it functionates more actively in an endeavor to flush the kidneys and thereby purify the blood. (Casper.) As a result of this there is "increased tension of pulse, accentuation of the aortic second sound, hypertrophy of the left ventricle, and occasionally of the right as well. As long as this augmentation in cardiac activity can prevent the accumulation of the toxic material in the blood, the term compensated renal disease may be used.

"Another expression of the toxic substances circulating in the blood is the occurrence of degenerative changes in the mucous membrane of the stomach, intestines and respiratory organs, and in the pleura, pericardium and retina. Thus gastritis, enteritis, bronchitis, pneumonia, pleuritis, pericarditis and retinitis are not uncommon affections in those afflicted with chronic nephritis." (Casper.) When fully developed, however, the leading clinical features of Bright's disease are the appearance of dropsy, which is progressive and obstinate, involving the loose cellular tissues and ultimately the serous cavi-



ties; a face pallid, puffy, and dough-like; failure of appetite and digestion; debility and helplessness are prominent and progressive symptoms. If uremia develops it is chronic in character; convulsions are not likely to occur, except at the close, or as the result of acute complications. (Purdy.)

The urine is reduced to about one-half the normal quantity, but late in the disease may increase to normal, or above, as the disease progresses to secondary contraction. The specific gravity is below normal, the color usually being dark brownish. There is a large sediment, consisting of epithelium, renal casts, red and white blood cells and granular debris. The renal cells often show fatty granules. The casts are numerous and of all varieties, but the most distinctive ones are the fatty, granular, blood and hyaline casts. Albumin is always present, and often in large quantities. There is a notable reduction in the quantity of urea and of chlorides.

CHRONIC INTERSTITIAL NEPHRITIS.—This is not generally considered as an outgrowth of the chronic diffuse nephritis, but rather as a slowly progressive chronic process, which ultimately produces a granular contraction or atrophy of the kidneys. The subjects affected by this disease are usually those previously robust, high livers and hearty eaters. It is stealthy and insidious in its onset, no well-marked characteristic symptoms manifesting themselves for a number of years, sometimes ten or twelve. The heart and arterial system furnish the first and most reliable diagnostic features. Purdy says that in at least 80% of the cases the chronic contracting kidney is accompanied by a progressive hypertrophy of the left ventricle of the heart. The pulse is full, hard and resisting to the finger, arteriosclerosis is nearly always present. When vision is affected it is rather late in the course of the disease. Uremic disorders may manifest themselves with such symptoms as diarrhoea, dyspnea,

neuralgia, drowsiness, coma, and sometimes convulsions. Severe attacks of bronchitis in the aged should arouse suspicion of chronic interstitial nephritis. Purdy bases the diagnosis upon the following points: A previous condition of robust health is usual; age, over forty years; patient rises regularly at night to void urine of normal appearance, the pulse is full and hard, never weak; the second sound of the heart is abnormally loud; urea is deficient and small quantities of albumin are present in the urine; casts are to be observed under the microscope if the sediment is concentrated. The albuminuria is intermittent in character and perhaps absent for a time, but it returns if there is any slight disturbance, as catching cold.

**AMYLOID DISEASE OF THE KIDNEY.**—This disease is characterized by its occurrence in weak, anemic individuals, enfeebled with syphilis or exhausting suppurating processes of the so-called wasting diseases. Dropsy is usually present, but uremia is rare. Digestive disturbances and diarrhoea are common. The urine has a light color, low specific gravity, and its volume is above normal. The serum-globulin may exceed the serum-albumin in quantity. The casts are hyaline and waxy, occasionally granular.

**THE PROGNOSIS.**—The prognosis in chronic diffuse nephritis is unfavorable, but in chronic interstitial nephritis a much better outcome may be expected, as these often run along for years without seriously impairing the patient's health.

After the development of albuminuric retinitis, the prognosis is always grave, many patients dying during the first year and few living beyond the second year, but much depends upon the proper management.

**TREATMENT OF CHRONIC BRIGHT'S DISEASE.**—The treatment is chiefly with carbonate of soda and acetate of potash,

and with non-medical prophylactic measures to overcome the malign influences in the environment, diet, hygiene or business affairs. Overwork and mental strain should be studiously avoided. Fresh air, sunlight and suitable underclothing of light wool, even for summer, are desirable. Worry and excitement are the most common causes of chronic nephritis, and, therefore, should be eliminated as far as possible from the life of the patient with incipient or fully developed kidney disease. The skin should be kept in a good secretory condition with tepid or hot baths just before retiring. A quick cold sponge bath in the morning may be of benefit if the reaction promptly follows and the patient does not feel chilled. Such baths tend to prevent colds. Moderate exercise in the open air may be permitted.

The diet should vary according to the occupation, but generally speaking we may say that it should be varied in character and always moderate in quantity. A certain number may do well on a strictly milk diet, but many more will do better on a more liberal one containing food which does not increase acidity. Especial care should be taken in the diagnosis, so as not to restrict too much a patient with amyloid disease in which more nutritious diet is necessary. The quantity of sodium chloride may be diminished; this injunction is of importance if there is edema, though Fischer takes exactly the opposite view. Alcohol, pepper and highly seasoned sauces should be excluded. Water should be taken in limited quantity, because in excess it throws extra work upon the kidneys. Von Noorden has suggested its copious use at intervals, not steadily.

Acute exacerbations should receive the treatment previously outlined for acute nephritis.

**SUMMARY.**—There are three general subdivisions of nephritis, parenchymatous, interstitial and diffuse. The etiology of

nephritis is not yet definitely known. An interesting theory is that of Fischer, who believes that these diseases are caused by too much acid in the kidney. While his theory has not been accepted as meeting all demands, it does suggest a plan of treatment which apparently gives better results than any other. He gives carbonate of soda, by mouth, per rectum or intravenously, according to the urgency and needs of the patient.

ACUTE NEPHRITIS begins suddenly with weakness, loss of appetite, headache, nausea, vomiting and edema of the ankles and wrists. The urine is scanty, dark and cloudy, or entirely suppressed. The treatment consists of rest in bed, and milk diet, and carbonate of soda (crystals), 1 to 1½%, in physiologic salt solution, should be given intravenously. The outlook is usually good.

The presence and significance of small amounts of albumin is a matter of much importance and should be carefully studied. There are many kinds of proteids in the urine which may be greatly misleading if one assumes that the mere presence of albumin means Bright's disease. Casts have somewhat the same significance as persistent serum albuminuria.

CHRONIC BRIGHT'S DISEASE may be parenchymatous or interstitial. The former is characterized by the presence of albumin and casts in scanty urine, pallid puffy face, poor appetite and weak digestion, debility and weakness; chronic interstitial nephritis presents a different picture, it occurs usually after 40 in robust, high livers and hearty eaters. The quantity of the urine is increased, albumin and casts may or may not be found. The left ventricle hypertrophies and arteriosclerosis is nearly always present. The vision is affected late in the disease, and diarrhoea, dyspnea, neuralgia, drowsiness, and coma later develop.

AMYLOID DISEASE OF THE KIDNEY occurs in weak anemic individuals, enfeebled by syphilis or exhausting suppurating processes. The urine is above normal in quantity, has a low specific gravity and contains hyaline and waxy casts. The treatment of chronic Bright's disease is largely alkaline, dietetic and hygienic.

CHAPTER XXVI.

INFLAMMATORY LESIONS OF KIDNEY AND RENAL  
PELVIS

LESIONS OF KIDNEY AND PELVIS, PATHOLOGY, SYMPTOMS, DIAGNOSIS, PROGNOSIS AND TREATMENT OF PYELO-NEPHRITIS, HYDRO-NEPHROSIS, PYO-NEPHROSIS, TUBERCULOSIS OF KIDNEY, NEPHRECTOMY, OPERATIVE AND TREATMENT.

RENAL CALCULI

SYMPTOMS, DIAGNOSIS, TREATMENT, OPERATIVE TREATMENT, SUMMARY

INFLAMMATORY LESIONS OF THE KIDNEY AND THE RENAL PELVIS.—These diseases are due to infection with the colon bacillus, streptococcus, staphylococcus, tubercle bacillus, gonococcus, and less frequently with the pneumococcus or the bacillus of typhoid fever. When the infection occurs from the blood stream it is called hematogenous, and when through the urinary tract, urogenous. The former may result occasionally in septicemia, pyemia, endocarditis, pneumonia, smallpox, measles and typhoid fever, while the latter occurs in cystitis, and especially if there is retention of urine as from stricture or hypertrophy of the prostate gland. Pyelitis is an inflammation of the pelvis of the kidney.

THE PATHOLOGY OF PYELO-NEPHRITIS.—The lesions consist chiefly of an exudative inflammation, with round-cell in-

filtration and small pus collections, which may increase in size and finally coalesce and form abscesses. The mucous membrane is swollen, and undergoes more or less degenerative changes. The pelvis may become irregularly dilated, and may be associated with an inflammation or obstruction of the ureter.

**THE SYMPTOMS.**—The symptoms of pyelo-nephritis commence with a distinct rigor or a succession of chills, followed by fever, which may run a very irregular course and reach 103 to 104 degrees in the evenings. The patient is weak, drowsy, thirsty, perspires freely, has drawn, pinched features, is nauseated and may vomit. The urine is always purulent, having a yellowish-dirty color, and emits a disagreeable odor. The reaction varies; the specific gravity is reduced. Albumin is always present; the sediment is abundant, consisting of pus cells in enormous numbers, bacteria, epithelial cells, blood and, usually, casts. There is a chronic form of pyelo-nephritis with much milder symptoms. If the ureters are obstructed a pyonephrosis develops. Inflammation limited to the pelvis of the kidney and the ureter may not be attended with casts.

**THE DIAGNOSIS.**—The diagnosis of pyelitis and pyelo-nephritis is based largely upon the history, symptoms and the presence of pyuria which is not assignable to the lower urinary or sexual organs. If tuberculosis and malignant growth of the bladder are eliminated, and the pus does not decrease after careful and persistent treatment, we may assume that the kidney or its pelvis is inflamed. It is necessary to catheterize the ureters and compare the urine from each side to determine whether or not both kidneys are involved, and to estimate, if possible, the extent of the pathological condition and the functional capacity of each kidney. Beer thinks that the passage of pus stained blue many months after the administration of methylene blue is indicative of the rupture of a parenchymat-

ous abscess, and is, consequently, diagnostic of pyelo-nephritis. He reports a very interesting and apparently conclusive case, which seems to support the above contention. More extensive research along this line may enable us to put this observation to practical use in making a differential diagnosis between pyc-



Figure 77.—Kolischer-Schmidt's Instrument Inserted into Patient. Catheter Inserted into Left Ureter, Slide Bar Half Way Withdrawn. S, Slide Bar. (Kolischer & Schmidt.)

litis and pyelo-nephritis. Methylene blue is deposited in the abscess, and remains there until the rupture.

A valuable method in the diagnosis of suspected cases is the examination of the urine before and after deep massage of the loin over the suspected kidney and along the ureter. A considerable increase in the amount of pus in the urine voided



after such a procedure, points distinctly towards a pyelo-nephritis, perhaps with parenchymatous abscesses upon that side.

The source of pus can be determined positively only by a cystoscopic examination and catheterization of the ureters. This method also determines if the inflammation is limited to one kidney, and enables the surgeon to decide whether or not the other kidney functionates properly. (See Diagnostic Aids in Renal Diseases).

**THE PROGNOSIS.**—The prognosis depends both upon the character of the inflammation and the degree of renal involvement. The pelvis of the kidney may be inflamed for years without serious impairment of the patient's health. When the kidney structure, however, is attacked by an active inflammation the prognosis is very grave.

**THE TREATMENT.**—Acute, suppurative conditions of the kidney and ureter require rest in bed, bland diet, plenty of lithia water, cupping or hot fomentations over the kidneys, vaccines, urotropin and potassium acetate internally, and regular evacuation of the bowels. If chills and fever are severe, and the surgeon has ascertained accurately which kidney is diseased, nephrotomy should be performed. In mild pyelitis improvement often follows irrigations of the renal pelvis with 1-2000 solution of nitrate of silver or 5% solution of argyrol.

If the kidney substance has been largely destroyed and the other kidney is known to be in good functional condition, the diseased kidney should be removed (nephrectomy).

**HYDRO-NEPHROSIS OR URO-NEPHROSIS.**—This is a collection of non-purulent urine in the pelvis of the kidney, due to some obstruction in the ureter. The pelvis and calyces become enormously dilated, and the secreting substance of the kidney undergoes an atropic and cystic degeneration, the cysts some-

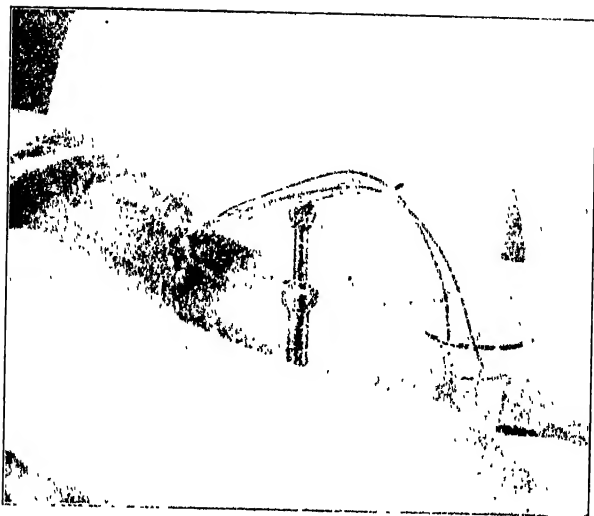


Figure 78.—Patient in the Reclining Posture for Collecting Urine Through the Urethral Catheters. Catheters Running Over Elevated Plane, Dipping into Glasses. (Kolischer & Schmidt.)

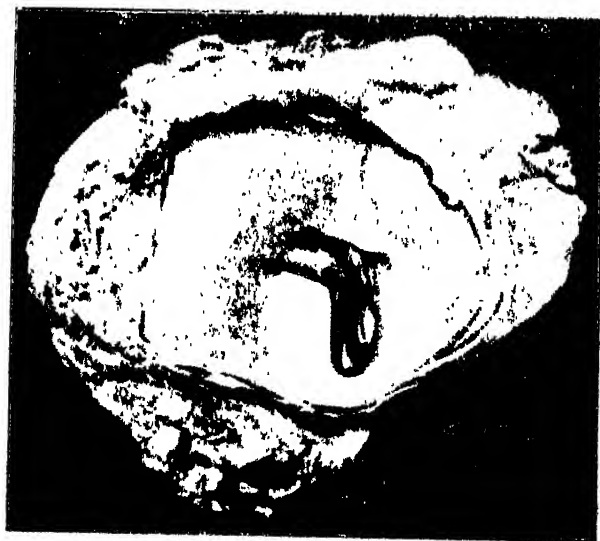


Figure 79.—Urethral Catheter Inserted into Other Ureter and Urethra to Prevent Tying up of the Ureter by the Preliminary Sutures. Ureteral Orifice; C, Catheter. (Kolischer & Schmidt.)

times attaining considerable size. H. Cabot has directed attention to the necessity of early diagnosis of hydronephrosis before destruction of the kidney has occurred. He insists that the diagnosis should be made at a time when the damage to the kidney is so slight that it is curable. The classical symptoms of intermittent pain, tumor, and a sudden increase in the quantity of urine will never enable one to make the diagnosis early enough to be of service to the patient.

**ETIOLOGY.**—There are two causes of hydronephrosis which stand out prominently, namely: (1) a "mobility of the kidney without a corresponding mobility of the upper portion of the ureter thereby producing a kink, and (2) abnormal renal vessels which play a part when the mobility of the kidney causes them to cut sharply across the pelvis and obstruct it." The ureter may become blocked by a renal calculus, ovarian tumor, and stricture of the ureter. The obstruction may be complete or it may be intermittent in character.

**SYMPTOMS.**—The symptoms are vague and indefinite at the start and usually simulate stone in the kidney or infection of the kidney. The examination shows negative tests for these suspected lesions. Later the symptoms consist of pain and tumor which may diminish with a decided increase in the amount of urine.

**DIAGNOSIS.**—The diagnosis presents many difficulties and may be made positively only after ureteral catheterization and as a result of practically all of the diagnostic methods previously described. After having shown the hydronephrosis to be present, we must eliminate all other causes as stone and infections, especially tubercular infection. We should further reproduce the pain the patient complains of by distending the pelvis of the kidney. The diagnosis is completed by X-ray plates, with

the pelvis distended with 10% collargol. The radiogram should be taken with patient reclining and also when standing so as to show the varying relation of the kidney to the pelvis and ureter.



Figure 80.—Ascending pyelonephritis, cystitis and hypertrophy of the prostate. (Taylor.)

PROGNOSIS.—The prognosis is not necessarily grave, unless pyo-nephrosis supervenes, as hydro-nephrosis may remain

stationary for years. The renal substance is gradually damaged, however, and eventually the entire kidney may be converted into a sac, leaving none of the structure in a healthy condition.

**TREATMENT.**—When the diagnosis has been made the treatment consists in removing the obstruction. If the mobility of the kidney is shown to produce a kink, and thus the obstruction, the kidney should be fixed. If stricture of the ureter exists it should be dilated with ureteral catheters and bougies. If a stone is the cause of the obstruction it should be removed. In advanced conditions drainage through the lumbar region or nephrectomy may be necessary.

**PYO-NEPHROSIS.**—Pyo-nephrosis is the term usually applied to a suppurating hydro-nephrosis. The infection may have been primary or secondary to the distention. Suppuration within the kidney substance is common to both varieties. When it occurs from an infected hydro-nephrosis there is much more distention than in the primary pyo-nephrosis, which may develop in the parenchyma of the kidney, without involving its pelvis.

**SYMPTOMS.**—The symptoms are persistent pyuria, which will not clear up under appropriate treatment, with perhaps the absence of cystitis; tenderness or a tumor in the kidney region, and finally a constitutional reaction indicating suppuration.

**DIAGNOSIS.**—The diagnosis may be made from a careful study of the evolution of the disease, with the above symptoms, but should go further and include ureteral catheterization, to observe from which ureter the pus is discharging.

The functional capacity of the other kidney should also be determined.

**TREATMENT.**—The treatment necessarily depends upon the extent and character of the inflammation and particularly upon whether one kidney or both are affected. If the other kidney is healthy, the diseased one should be incised, or, if its substance is largely destroyed, nephrectomy should be performed.

### TUBERCULOSIS OF THE KIDNEY.

The tubercle bacillus may reach the kidney through the blood or by direct extension from the bladder, the latter case being comparatively rare. Tuberculous infection is described as ascending or descending, according to its origin in the lower genital organs with gradual ascent to the kidney, or to a primary renal tuberculosis, which may descend and infect the bladder. Renal tuberculosis usually occurs between the twentieth and fortieth years.

**PATHOLOGY.**—The pathology is similar to tuberculous processes in other organs of the body; the primary form begins as nodules; later these tubercles caseate and leave cavities surrounded by granulating, ragged, irregular walls. The disease is frequently unilateral.

**THE SYMPTOMS.**—Beginning renal tuberculosis may present no manifestations. The general health may fail, fever may or may not be present, emaciation and a sallow complexion gradually develop. A dull, heavy pain may be felt in the lumbar region, and by palpation an enlargement may be found, which is less movable than the normal kidney, and other renal tumors; distinct pain is produced on pressure and the kidney region seems more resistant than usual. The urine contains pus, and tubercle bacilli also may be found. Casper claims that blood cells are seldom absent, but that macroscopic hemorrhages are not of frequent occurrence. Albumin will be present if there is much involvement of renal tissue, or if there is a cavity openings may show by their everted ulcerated appearance which

kidney is diseased. Early in the disease the urine may be clear and increased in amount. Frequent and painful micturition may occur either from a severe inflammation of the pelvis of the kidney, or from an extension of the process to the bladder.

DIAGNOSIS.—An early diagnosis is naturally difficult to make. A deep seated chronic gonorrhoea or other infection may add to confusion in the diagnosis. Of course the history should be carefully taken and the lungs, epididymis, glands and other parts of the body examined for tuberculosis. Persistent pyuria, without any assignable cause, should arouse suspicion of renal tuberculosis.

The penis should be washed and the urethra and bladder thoroughly irrigated. The urine is then collected, mixed with albumin, centrifugated, and the sediment stained for tubercle bacilli. The washing and irrigation are to eliminate the smegma bacillus and the albumin is added to make the sediment stick to the slide or cover glass while it is being stained and washed. If the search is negative, the sediment may be inoculated into the peritoneal cavity of a guinea pig. Evidences of tuberculosis may be demonstrated by a post-mortem examination, after five or six weeks. Bloch recommended that the washed sediment be injected into the thigh of a guinea pig, and at the same time that the inguinal glands on the same side be crushed between the fingers, and claimed that if tubercle bacilli are present, they may be found, after nine days, in the glands.

Cystoscopic examination is of great value, as the ureteral penings may show by their everted or ulcerated appearance which kidney is affected. Ureteral catheterization may be necessary to locate the diseased and determine if the other kidney has sufficient functional capacity to sustain life after the removal of the tubercular one.

**THE PROGNOSIS.**—The prognosis of renal tuberculosis is favorable if the diseased kidney is removed early. Otherwise there will be an extension or general dissemination of the process, which will result in death. If the disease is secondary to tuberculosis elsewhere, the prognosis is unfavorable.

**TREATMENT.**—If the disease is bilateral or other foci exist, palliative treatment is indicated. This consists of plenty of nutritious food, flannel underwear, outdoor life in a dry, equable climate: urotropin in ten grain doses three times daily, and regulation of the bowels. The tuberculosis of the bladder may improve after removal of the diseased kidney. If the cystitis persists inject every other day, 50 c.c. of a freshly made 6% phenol solution through a catheter into the bladder, after it has been irrigated with sterile water. It is allowed to remain in the bladder three minutes and it comes away as a milky fluid. These injections are continued until the phenol solution returns fairly clear. The treatment, though painful, is often promptly effective.

**NEPHRECTOMY** is the operation of choice when only one kidney is affected and the other has good functional capacity, even if there is slight involvement of the lungs or bladder.

Two routes are available for removal of the kidney, through a lumbar incision, or through the trans-peritoneal route in which the incision is made through the linear semi-lunaris. The first route is less dangerous, and therefore preferable. The patient should lie on the healthy side with a Mayo support, an air cushion or sand bag under the lumbar region, to make the opposite side as prominent as possible. Various methods have been devised for reaching the kidney through the loins, but we will only describe briefly the so-called costo-iliac incision, which commences over the eleventh rib, extends along the lateral border of the sacro-lumbalis muscle to the crest of the ilium, from



which it may be curved forward several inches farther when more room is desired. The skin, the subcutaneous tissue, the latissimus dorsi muscle and the lumbar aponeurosis are divided, and the muscle fibers separated. The peri-renal fat is separated and removed until the posterior surface of the kidney is reached. With a strip of gauze wrapped around operator's finger the kidney is readily brought into view. The pedicle is isolated, and the artery, vein and ureter are tied separately, in the order mentioned, when possible; otherwise the pedicle is tied in mass with braided cat gut, passed by means of a large aneurysm needle. The space from which the kidney has been removed, if pus or inflammation has been present, should be packed with iodoform gauze extending out to the wound, the rest of the incision being carefully closed layer by layer.

### RENAL CALCULI

Renal calculi originate in the substance of the kidney or in its pelvis, and from around epithelial cells, mucus, blood clots or shreds of tissue. Several different layers may be deposited around the nucleus on account of variations in the quality of the urine. The stone substance is held together by peculiar albuminoid or colloidal material, which is produced by the irritated or inflamed surface. Renal stones occur more frequently in men than in women, and have a tendency to form in the kidneys of persons leading an indolent, sedentary life.



Figure 81.—Kelly's wax-tipped ureteral catheter with scratch.

Kahn and Rosenbloom have presented recently an elaborate chemical analysis of twenty-five renal calculi and of two cystic calculi and of two cystic calculi, which showed that true renal calculi were composed al-



Figure 82.—Stone in the right kidney. (Derr.)

most entirely of calcium salts, while cystic calculi were almost entirely uric acid. Their work confirms that of Rolands, Mackarell, and Moore and Thomas and thus shows that in the past our conventional method of recommending alkaline remedies

to prevent the formation of stones was wrong. Kahn and Rosenbloom concluded from their analyses that:

1. The large majority of renal stones are composed of oxalate of lime. 2. Uric acid and the urates are found in all renal concretions, but it is rare to find a renal calculus that is

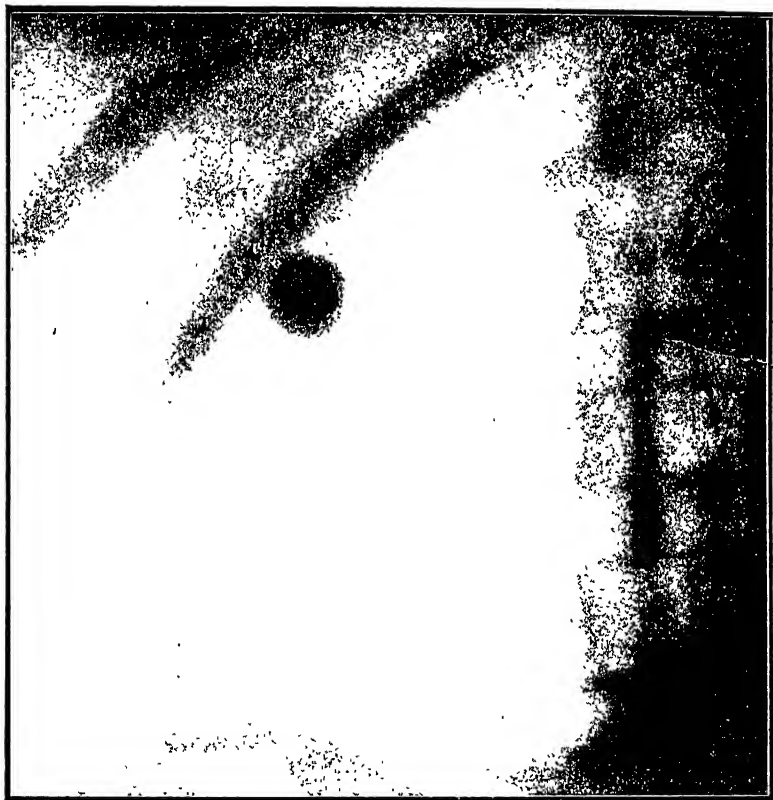


Figure 83.—The Shadow of a Soft or Past Stone in the Same Situation from which a Formed Stone had been Removed about a Year Previous. (Derr.)

mainly composed of urates. 3. The shape, color, consistency, etc., of a stone do not form a criterion of its chemical composition.

**SYMPTOMS.**—The symptoms may be so slight that a stone may be carried for years without the patient being aware of its presence, or the manifestations may be very intense—such as pain in the lumbar region, along the ureter and down in the

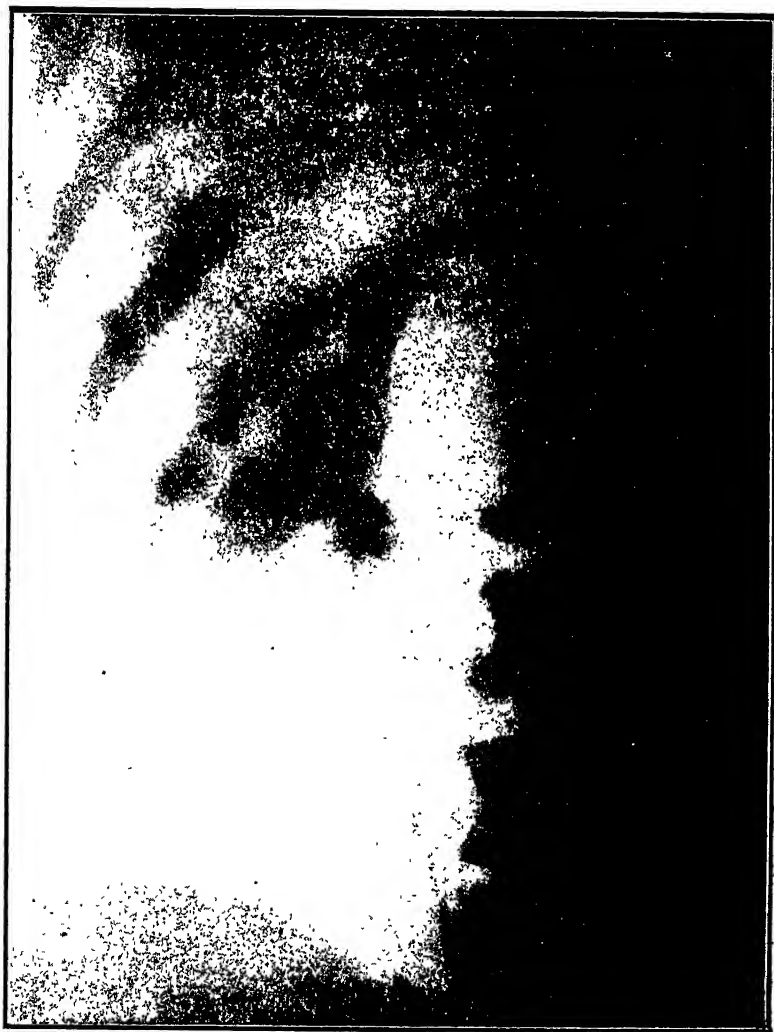


Figure 84.—Collargol Injection Showing the Course of the Ureter and Dilation of the Kidney Pelvis and Calices with Tilting of the Kidney. (X-ray by Derr.)

testicle or at the end of the penis, nausea, vomiting, prostration, frequent micturition, and perhaps tenesmus. The urine is diminished, and, unless the condition is relieved, may be suppressed entirely. Active exercise will nearly always cause the

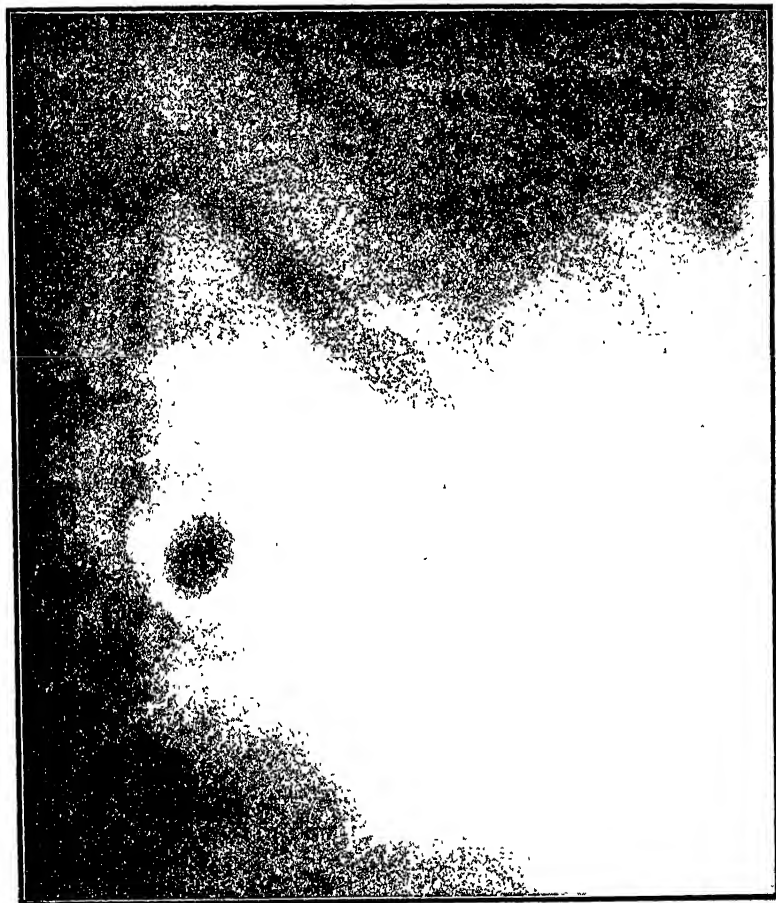


Figure 85.—Stone in the Pelvis of the Ureter. (X-ray by Derr.)

appearance of red blood cells in the urine (examined with a microscope after centrifuging) and renal sand may be found in the urine quite frequently. After the obstructing calculus has be-

come displaced there may be a flow of bloody urine, containing leucocytes, pus and desquamated epithelial cells.

Renal colic is very likely to occur after exercise or severe jolting. The stone may be passed subsequently through the urethra, or it may remain in the bladder.



Figure 86.—The Upper Shadow is a Formed Stone. Those Below are Masses of "Paste" or "Sand" in a Fistulous Tract which Opened in the Back just above the Crest of the Ileum. (Derr.)

**DIAGNOSIS.**—Periodic attacks, characterized by the symptoms, strongly suggest stone in the kidney, especially if no other condition can be demonstrated to which the

toms may be attributed. The X-ray is a valuable means of diagnosis, but the photograph should be taken by an expert, after the bowels have been emptied, and after the passage of ureteral catheters that are impervious to the X-ray, as calcare-

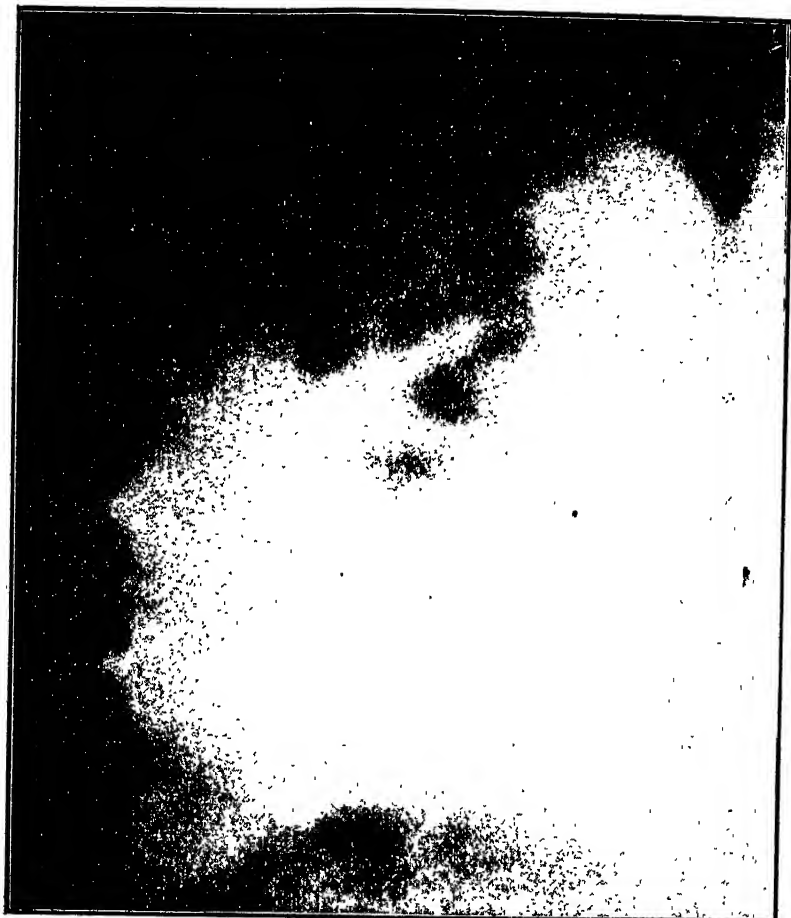


Figure 87.—A Number of Large Stones Contained in the Shell of The Destroyed Kidney. (Derr.)

ous lymphatic glands may lead to a serious error in the diagnosis. The ureteral catheter with its tip coated with wax is a useful instrument in determining the presence of a renal cal-

culus. Massage over the region of the kidney, followed by the examination of the urine for blood, is also of value. Hard stamping of the foot, after bringing the leg well up against the abdomen, is thought to cause pain in the kidney if stone be present.

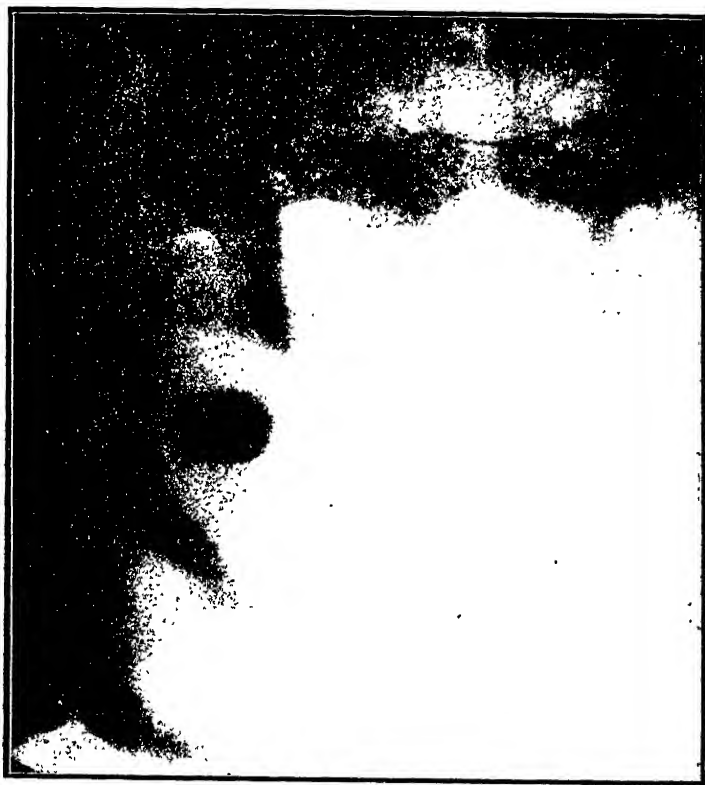


Figure 88.—Stone in the Pelvis of the Kidney. (X-ray by Derr.)

**TREATMENT.**—The prophylactic measures depend upon whether the urine shows an excess of calcium oxalate or of uric acid. With the former condition the patient should drink large quantities of distilled water and avoid the acid fruits and vegetables, while with the latter, large amounts of lithia water should be ingested and more outdoor exercise should be taken.



A diminution in the amount of food, and especially the nitrogenous forms, is indicated. Kahn and Rosenbloom assert that the usual antacid treatment is just the opposite of what is indicated, because while uric acid and its salts are soluble in alkaline mediums and insoluble in acid, the exact opposite holds for calcium oxalate and calcium phosphate, which are deposited in alkali mediums and dissolved by acids.

They therefore conclude that all calculi obtained by operation or otherwise should be subjected to chemical analysis and that if they are found to be composed of calcium salts, no anti-acid treatment should be advised, but instead a course of acid treatment. If infection has taken place urotropin should be administered and the general plan of treatment carried out as described for pus kidney.

Renal colic requires morphine in sufficient quantity to relieve the pain. It should be remembered, however, that in case the stone suddenly passes, the patient may become poisoned, if too much morphine be given. If the morphine is not sufficient to relieve the pain, chloroform, by inhalation or internally, should be administered. Hot baths, hot fomentations and hot water internally are all of some value. To aid in the expulsion of the stone Francis S. Watson strongly recommends the following treatment:

"Spirits of turpentine in 10 minim doses in gelatine capsule t.i.d. Diet of milk, each tumbler diluted one-quarter part with water, milk to be slightly warmed and drunk slowly. Fish and dry toast may be taken once daily. Patient is to rest recumbent during the regimen and to take occasionally hot sitz baths. Treatment to last six days consecutively, then after a two-day interval it is repeated once or twice, if necessary. After one month, or six weeks at most, of this treatment, if the stone has not passed, it should be removed by surgical operation. In every case in which the patients were freed from their calculi by

medical treatment, cure was absolute, and in twenty of them the patient's subsequent history was followed from three to twenty years subsequently. In but a very small number of these—six—was there any recurrence of the trouble. These patients got rid of their recurring calculi under the same treatment as was



Figure 89.—Double Kidney Stone. (Derr.)

employed in the first instance. In seven of the cases treated medically the calculus failed to pass. The patients were operated on successfully later. In 87 per cent. of Watson's fifty-four patients thus treated, in which the calculus was small enough to pass through the ureter, it was spontaneously expelled, while the patients were under medical treatment."

The drinking of large quantities of distilled water affords one of our most valuable measures in preventing the recurrence of stones in the kidney.

OPERATIVE TREATMENT is indicated if the stone is impacted in the kidney and suppuration seems likely or exists, or

if the stone is blocked in the ureter and is producing hydro-nephrosis or pyo-nephrosis. Nephrolithotomy may be performed; this is not a very dangerous operation. The kidney should be exposed, as previously described, and a search made for the calculus by palpating the kidney, or if this is unsuccessful, by making an incision into the cortex. If found by palpation in the pelvis, pyelotomy should be done. If the stone is in the substance of the kidney and can be detected without the previously mentioned incision, it should be removed preferably through Broedel's line, as here the hemorrhage will be less than if the incision is made through other parts of the kidney. The kidney should be closed with mattress sutures. The incision into the pelvis of the kidney does not require suturing. It is well to leave a gauze or cigarette drain down to the kidney regardless of whether infection exists or not.

**SUMMARY.**—Infection of the kidney may arise from the blood stream or extend up the ureter from the bladder. The inflammation may be acute or chronic in character. In the acute, the diagnosis is made from the large amount of pus in the urine, the renal symptoms and history. The chronic can only be diagnosed by ureteral catheterization. The treatment of the acute inflammation of the kidney and its pelvis consists of plenty of lithia water, urotropin, rest in bed, bland diet, hot fomentations and potassium acetate. In the chronic form, with perhaps obstruction of the ureter, the kidney should be removed.

**HYDRONEPHROSIS** is a collection of non-purulent urine in the pelvis of the kidney, due to some obstruction in the ureter as a link or anomalous blood vessels with a movable kidney; a stricture of the ureter; or a stone lodged in the ureter. The diagnosis should be made before the renal structure has been destroyed. All possible causes should be eliminated.

by a painstaking search with X-ray, ureteral catheterization and pyelograph, and the pain should be reproduced by distending the pelvis of the kidney. The treatment concerns chiefly the removal of the cause of the obstruction. PYO-NEPHROSIS is the term applied to suppurating renal lesions. If the tests show the other kidney to be healthy, the diseased kidney should be removed. TUBERCULOSIS of the kidney requires patient, careful study to correctly make a diagnosis early when operative measures afford satisfactory results. The cystoscope usually reveals an ulcerated or everted ureteral opening on the affected side. Catheterization is necessary to confirm the suspicion and determine the condition of the opposite kidney. The collected urine should be examined for tubercle bacilli, as well as for its quality from a renal functional standpoint.

RENAL CALCULI may cause very intense pain or none. The pain may occur from the lumbar region down to the testicle or penis; other symptoms are nausea, vomiting, prostration, frequent micturition and at times tenesmus. Physical exertion and jolting may bring on the attacks. If the stone passes down the ureter violent pain is caused. Its expulsion may be aided by 10 minim doses of turpentine, hot fomentations to the loins, copious draughts of liquids, rest in bed, morphine, and ether or chloroform, if necessary, to control the excruciating pain. If it fails to pass from the kidney or through the ureter, it should be removed by operation. Stones obtained by operation or otherwise should be subjected to chemical analysis, and if they are found to be composed of calcium salts the usual antacid treatment, formerly so much used, should not be advised, but instead the acid treatment.

## CHAPTER XXVII.

## SYPHILIS

HISTORY, ETIOLOGY, SPIROCHAETA PALLIDA, TECHNIC OF DEMONSTRATING, CULTIVATION, DIFFERENT STAGES IN LIFE CYCLE, JELLY METHOD, DEFFERENT STRAINS AND SUMMARY

Syphilis is an infectious disease affecting the entire organism, and is due to the *treponema pallida*, or *spirochaeta pallida*, which gains entrance into the human body by direct, mediate, or hereditary infection. Acquired syphilis begins as a more or less characteristic lesion known as a chancre or hard chancre. From this point the germs spread throughout the body, but invade with special activity the connective tissue. Syphilis may simulate many diseases and is known as the "great imitator." It also greatly "modifies" or "alters" the course of other co-existing diseases.

HISTORY.—The history of syphilis is very interesting; but little was known of it before the latter part of the 15th century A. D. On account of a widespread outbreak about the time of Christopher Columbus' return from the discovery of America, it was claimed that syphilis was brought to Europe by his sailors. Reliable investigators have shown that it existed previously, but far less extensively. Of one thing we are certain, and that is, about 1494, a most malignant form of syphilis spread throughout Europe and was severe among soldiers of the French army then besieging Naples. Both Dupuy and Duchesne have asserted that syphilis existed in Europe many years before the voyage of Columbus, and Lydston says that the ancient writings of Chinese and Japanese show that it was known as long

as two thousand years ago. Prof. Joseph Jones studied the bones found in ancient burial places in the Southern States, and demonstrated apparently unmistakable evidences of syphilitic necrosis, osteitis, nodes and caries.

Fracastor gave the name "syphilis" to a shepherd who was a lover of Venus, and who, having incurred her jealousy, was afflicted with this disease. Fracastor narrates the history of this romance in a poem entitled "Syphilis" and describes the course of lues in this shepherd. Another version is that the name is of Greek origin and comes from "sōs," and "philos," friend, meaning a friend of a sow, prostitutes being known at that time as sows. (American Journal Dermatology.)

The remote antiquity of syphilis seems established, says the American Journal of Dermatology, by the document discovered by Captain Darby; this is the oldest account of syphilis in existence, having been compiled 3500 years before Christ, and reveals the interesting fact that mercury was used at that time to expel the syphilitic virus from the blood.

ETIOLOGY.—Until recently no organism had been isolated as the cause of syphilis, and although a large number have been advanced as the infecting germ, none has stood the test of subsequent independent investigators except the *treponema pallida*. This organism was discovered in March, 1905, by Schaudinn and Hoffmann while they were trying to find the cytorrhcytes flagellates of Seigel. Since that date numerous workers throughout the world have been able to demonstrate this germ in all of the contagious lesions of syphilis, as well as in gummata, cerebrospinal fluid, and in the liver, spleen, lungs, and other organs of babies dying of hereditary syphilis.

The *treponema pallida*, or *spirochaeta pallida*, is a very slender, faintly refractile, spiral-shaped, actively motile micro-organism from eight to fourteen micro-millimeters in length, about a half micro-millimeter or less in thickness. It has

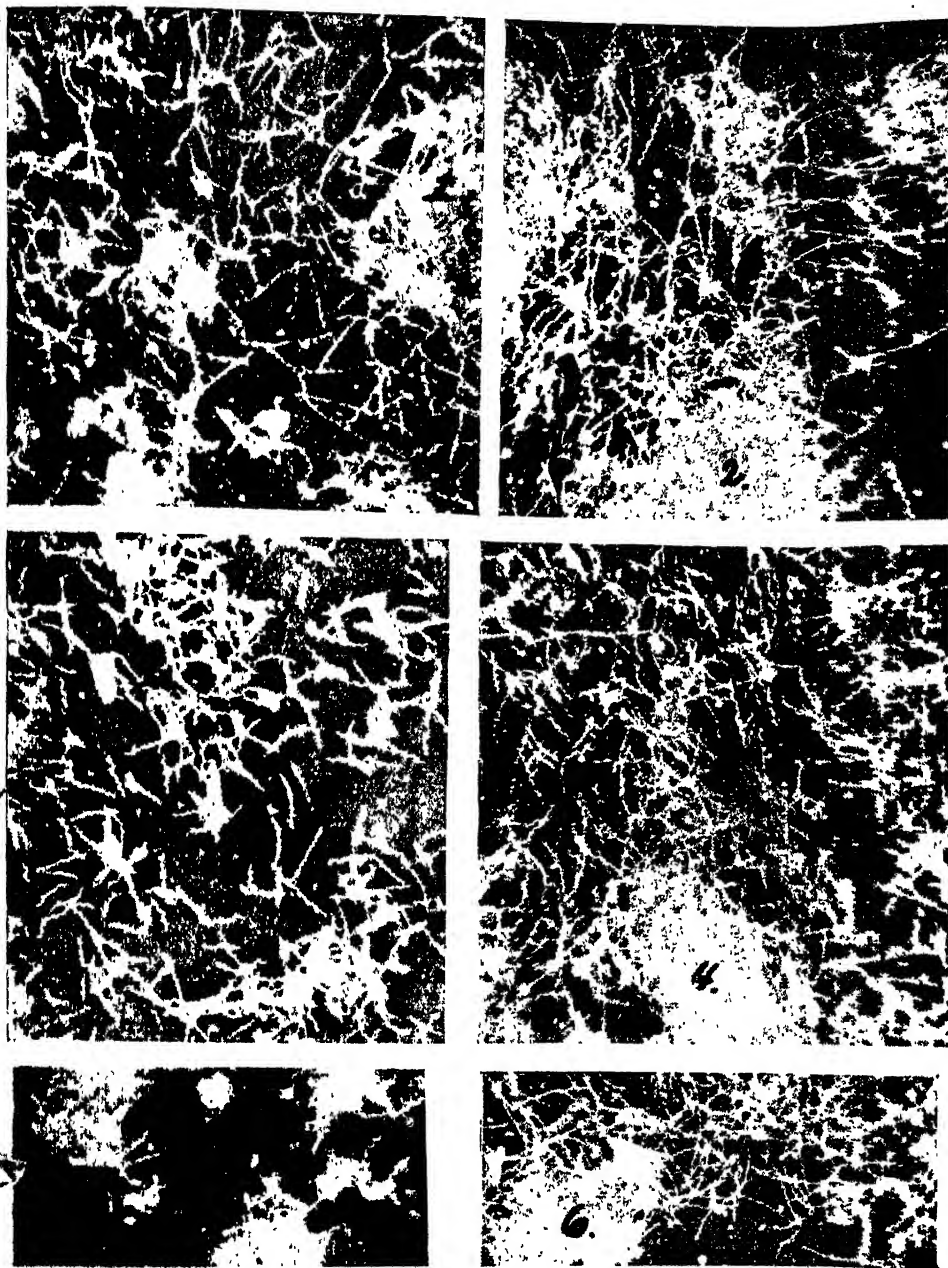


Figure 90.—*Treponema* from cultures. 1 and 2, *Treponema mucosum*;

from ten to fifteen turns, the curves of which are smaller toward each extremity, and it terminates in decidedly pointed ends. It apparently belongs to the protozoa and Schaudinn thought that he sometimes found a flagellum at one or both ends; it differs in this respect from certain other varieties of the spirochetes which have an undulating membrane. Much patience and experience are necessary in differentiating the *treponema* from the other spirochetes, of which there is a large number. The *spirochaeta refringens* is often found in sores and chancres, but differs from the *spirochaeta pallida* in that it is larger, has wider curves, blunt ends and stains deeply. The *spirochaeta microdentium* and the *spirochaeta macrodentium* (Noguchi) are found in ulcerated gums and lesions of the mouth and are similar to the *treponema pallida*. There is also a spirochete present in certain forms of sore throat, which is like the *treponema pallida* in shape, but is much larger and readily stains with methylene blue. The *treponema pallida* belongs to the trypanosomidae, of which there are three genera—the *spirochaeta*, *trypanosoma* and the *trypanoplasma*. (Blanchard.) Castellani has demonstrated a spiral micro-organism in the early lesions of yaws, which is very much like the *treponema pallida*, and which he has named the *spirochaeta pertenuis*.

The *spirochaeta pallida* has been demonstrated in all of the contagious lesions of syphilis, such as the chancre, mucous patch, condyloma and ulcerating or eroded surfaces. They have been found in the skin lesions, blood, lymphatic glands, serum from blisters during the primary and secondary stages, and in the saliva syphilitic individuals. (Follet.) The most conclusive evidence of the pathogenesis of the *treponema pallida* seems to be its hereditary transmission; it has been discovered in large numbers in the liver of syphilitic foetuses and in smaller numbers in the spleen, kidneys, supra-renals, lungs and other organs, as well as in the bullae of syphilitic pemphigus.



A number of observers have reported a patient now and then in whom spirochaeta pallida were discovered in tertiary lesions. This is in accord with the clinical observation that on rare occasions infection may be contracted from tertiary lesions.

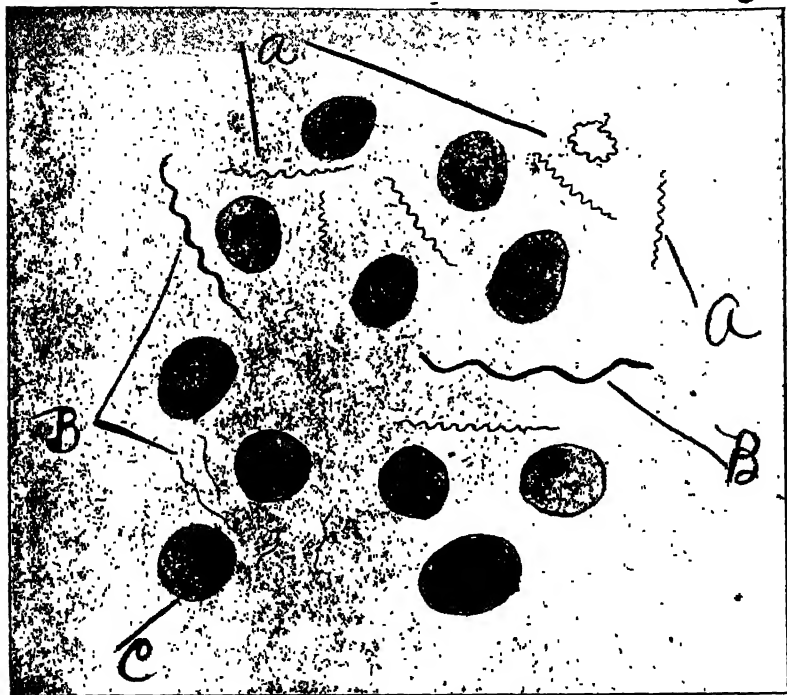


Figure 91.—A, *Treponema Pallida*; B, *Spirochaeta Refringens*; C, Red Cells.

#### TECHNIC OF DEMONSTRATING THE SPIROCHAETA PALLIDA.

—Since they are exceedingly slender and stain very badly, much difficulty may be encountered in demonstrating the *treponema pallida*, especially until one becomes thoroughly familiar with the methods of obtaining the smears, and has clearly in mind the appearance of the organism. By far the most satisfactory method of demonstrating the *spirochaeta pallida* is by the

dark field illumination. The chancre should be washed with tepid water and then well squeezed, the first secretion being wiped away. We then wait for about five minutes for more secretion to ooze from the lesion. This is placed on a slide and immediately covered with a cover glass and sealed under it with melted paraffin applied with a small cotton mop. It is now ready for examination. The *spirochaeta pallida* are seen as small, curly, silvery streaks, actively motile, but not passing rapidly across the field as do other spirochetes. Their curves are uniform and fine. After trying many staining methods, we have discarded all as being less reliable than dark field illumination. Even with it we are unable to differentiate the *spirochaeta pallida* from the *spirochaeta dentium* in case the secretion is taken from a lesion in the mouth, throat or tonsil.

The original Giemsa method of staining is as follows: Thin smears are made on slides or cover glasses, and, after being thoroughly dried, are fixed for ten to twenty minutes in absolute alcohol. They are then placed for sixteen to twenty-four hours in a freshly made mixture of 12 parts Giemsa's eosin solution (25 c.c. of 1 per cent. of eosin to 500 c.c. of water) 3 parts of azur 1 (solution 1-1000 water) and 3 parts of azur 11 (solution 0.8-1000 water).

After rinsing they are mounted in oil of cedar or acid-free Canada balsam. Giemsa has modified this method and made it simpler: Azur II eosin 3 parts; azur II 0.8 part dissolved in methyl alcohol 250 parts and then added to 250 parts of glycerin. After fixing in absolute alcohol the stain is poured on the specimen or diluted with an equal quantity of water and then applied. Within fifteen minutes an experienced observer can detect the *spirochaeta pallida*, which are more distinct, however, after 12 to 24 hours. The smear should be washed under a tap and mounted as in the former method.

Next to the dark field illumination comes the India ink method, which is not a stain, but shows the spirochetes by the clear space it occupies in the dark field of ink. The technic is as follows:

The India ink is diluted with two parts of water; one drop is then well mixed on a slide with a drop of the secretion to be examined. After mixing, it is smoothly smeared on the



Figure 92.—*Spirochaeta Pallida*. (McKee.)

slide and is allowed to dry. It is then ready for examination with the oil-immersion lens. Owing to the formation of artefacts and to the presence of spirochete-like bodies in the ink this method has been discredited. No matter what method is used a control smear should be stained with methylene blue; if the suspected spirochetes take this stain, we are safe in assuming that they are not the *spirochaeta pallida*.

Bertarelli, Volpino and Levaditi have stained the *spirochaeta pallida* within the tissue by using a modification of the

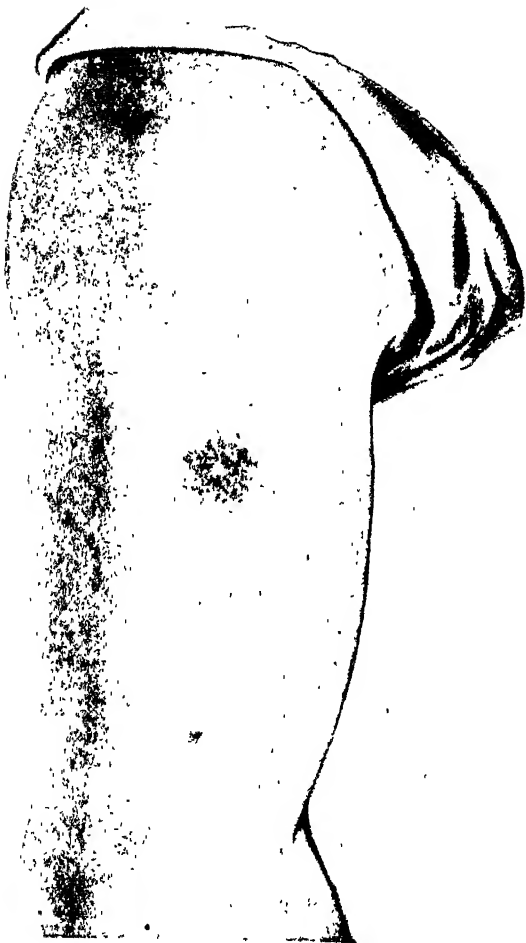
Raymon y Cajal nerve stain. Schmorl has described a method of staining them in the tissue by the Giemsa stain.

Negative examinations should never be considered final, but further search made or a positive statement withheld, pending developments.

**CULTIVATION OF THE SPIROCHAETA PALLIDA.**—Many investigators have attempted to obtain pure cultures of the spirochaeta pallida outside of the animal body but without success, until Noguchi succeeded in obtaining pure cultures of this organism. Muchlens and Hoffmann cultivated as pirochaeta similar to the spirochaeta dentium. Noguchi describes his technic as follows:

“Since 1910 I have been working on the cultivation of spirochaeta pallida and have succeeded in isolating six different strains from the orchitic material of rabbits, and seven directly from chancres, condylomata and skin papules of human subjects. The methods used are different, according to whether the pallida is to be cultivated from the orchitis of rabbits or directly from man. For the former, which contains the pallida in almost pure state, a fluid medium is preferred. A serum-water containing a piece of sterile fresh tissue is inoculated with the emulsion of the spirochete and cultivated under most strictly anaerobic conditions. After the first generation of the growth is obtained, it is more and more acclimated to the artificial cultural conditions by passing repeated subcultures in the fluid media. Then the pallida is transferred to a solid medium containing the suitable nutriments and fresh tissues. If the culture is impure, it can be purified in solid media by a special technic.

“On the other hand, a fluid medium is unsuitable for obtaining a growth of the spirochete when the human material is utilized, because the medium undergoes, through the growth of accompanying bacteria, such changes that it renders the medium unfit for the growth of pallida. For this reason, I have



Noguchi's Luetin Cutaneous Reaction.

## NOGUCHI'S LUTIN CUTANEOUS REACTION.

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Luetin is an emulsion of pure culture of several strains of the *spirochaeta pallida* in a media in which they grow anaerobically, namely ascitic fluid agar. (See cultivation of the *spirochaeta pallida*). Luetin is similar to tuberculin. A control emulsion without the *spirochaeta* is used simultaneously as a check. Equal parts of the luetin and sterile physiologic salt solution are mixed and injected intradermically. The dose for adults is 0.07 c. c. and for children 0.04 or 0.05 c. c. The control is first diluted, as the luetin, and injected within the skin, not subcutaneously, with a fine hypodermic needle. The luetin is then injected in the same manner about two inches from the control. The local reaction which follows within forty-eight to seventy-two hours shows whether or not syphilis is present. The test is more delicate if done ten days after an intravenous injection of salvarsan or neosalvarsan. Observations should be continued for four or five weeks. Occasionally a positive reaction will occur in the control in late lues, due to the susceptibility of the skin of such individuals to trauma (umstimmung.) The erythema which sometimes appears within twenty to thirty hours at the site of the luetin injection should not be considered a positive reaction. Noguchi divides the positive reactions into the papular, vesicular, pustular, torpid, and hemorrhagic, according to the varying characteristics. Occasionally there is a constitutional reaction with a rise of temperature, malaise, nausea, etc.

The luetin reaction is thought to be due to a hypersensitiveness to the spirochetal proteids—allergy—and therefore is not usually present in active primary and secondary syphilis. The reaction is of greatest value in latent lues, when the Wassermann is less likely to be positive. The test should be employed to supplement, but not supplant, the Wassermann reaction.

esorted to the use of a solid medium consisting of one part of ascitic fluid and two parts of weakly alkaline agar with a piece of sterile fresh tissue at the bottom. The percentage of success depends on the suitability of the medium which can vary considerably with different specimens of ascitic fluids used, and also on the adaptability on the part of the strains of the pallida.

"They grow slowly and steadily around the tissues and form very faint, diffuse, undefined colonies, extending gradually. The spirochete is strictly anaerobic and requires the presence



Figure 93.—Microphotograph Showing the Delicate Spirochaeta Pallida and also the Coarser Spirochaeta Refringens. (Blum.)

of a fresh sterile tissue for development. It does not attack the protein constituents of the tissue or serum, nor does it produce an odor in growth in any medium. The cultivated pallida is less actively motile, but the variety of the movements is characteristic. Under unfavorable cultural condition its morphology becomes less typical. The growth continues for several weeks. It has been noticed that the pallida strains isolated from the rabbit's orchitis grow more luxuriantly in a medium containing rabbit serum, while those from the human chancres prefer the ascitic fluid agar. It appears as if the passage of the pallida through the rabbit's body modifies the biologic property of this organism.

"In regard to the pathogenicity, I have succeeded in producing typical orchitis in several rabbits by means of pure cultures of the orchitis strains. With the human strains I was able to produce the initial lesions on the skin of *Macacus rhesus* and *Cercopithecus callitrichus*. The Wassermann reaction developed in these monkeys after the appearance of the induration several weeks after the inoculation.

"The above identification of my cultivated pallida strains seems to amply justify my assertion, but I am now in the position to offer further evidences of its identity by means of the immunity and allergic reactions.

"The *Spirochaeta pallida* is indistinguishable from *spirochaeta microdentium* by the morphologic characteristics, but is well differentiated from the latter by the requirement of tissue for growth, the absence of a putrefactive odor, the pathogenic property, the positive complement fixation with the antiserum produced in animals by immunizing them with pure pallida extract (such as the syphilitic orchitis of rabbit), and its capability of inciting an allergic reaction in syphilitic patients. The macrodentium and refringens can be easily differentiated from the pallida by their morphology alone, although they behave quite differently in other respects as well."

"In identifying a cultivated spirochete with *spirochaeta pallida*, the following points must be fulfilled:

1. The spirochete must be morphologically correct.
2. It must not produce a putrefactive odor.
3. It requires the addition of fresh tissue for growth.
4. Its extractor emulsion must bind complement with the immune serum (rabbit is preferred) produced by means of repeated injections of the tissue pallida (to be obtained from syphilitic orchitis of rabbits).
5. Its extract or emulsion must give an allergic reaction in certain cases of syphilis.



6. It should be pathogenic. The last requirement is highly important, but one cannot exclude the possibility of the organism still being the pallida, even if it is avirulent, as long as it fulfils the other five points, because it is not impossible that a strain of pallida may become attenuated in cultivation."

Baerlack has succeeded by a simpler method in cultivating the spirochaeta pallida by inserting a piece of tissue containing the organisms into coagulated horse serum, by grinding up the tissue, diluting it with broth and making inoculations into this medium by means of a capillary pipet. He says:

"To inoculate with tissue it is best to use it in as fresh condition as possible. The tissue is divided into small pieces, the size of a split pea. With a sterile platinum wire the tissue is placed deep in the medium between the wall of the tube and the medium. The introduction of air bubbles must be avoided. The consistency of the mediums permits this method of inoculation without tearing. It has not been found necessary to place neutral oil on the surface of the mediums. The inoculated tubes are placed in a desiccator containing pyrogallie acid, and the desiccator is then exhausted and hydrogen passed through it until a test-tube held to the outlet tube contains hydrogen. Suction is again applied to produce a vacuum in the desiccator and a strong solution of potassium hydroxid is run in through the outlet tube.

"The growing *Treponema pallidum* may be observed to radiate from the tissue implanted in the coagulated horse-serum in the form of a very faint cloud. The colonies are not sharply defined, nor distinct in their outline. The object of implanting the tissue near the wall of test-tube is to permit the growing treponema to penetrate into the medium. Thus one is enabled to obtain pure cultures. The cultures growing in the ascitic-agar, plus tissue, grow deeply at first and gradually the growth extends in a fine haze to within an inch of the surface of the medium."

PERHAPS DIFFERENT STAGES IN LIFE CYCLE OF SYPHILITIC ORGANISMS.—McDonagh has advanced the suggestion that the spirochetal form of the parasite of syphilis is but a single stage in the course of the development of the organism. As the result of an extensive study of the juices of lymphatic glands, and of cut sections, he believes that he can trace the following steps: The life cycle begins with motile sporozoite which enters a large mononuclear cell, where it becomes motionless, grows larger, and becomes invested with a distinct mantle of protoplasm. Development continues at the expense of the protoplasm of the mononuclear cell. The sporozoite then divides into two large, nongranular, staining masses. One-half becomes vacuolated and is transformed into an irregular coil which is of uneven thickness. At the base of this coil, lying just above the nucleus of the cell and in the protoplasm of the cell, are some rod shaped bodies. The coil then becomes extracellular and breaks up into short, wavy bodies. From these the long, spiral spirochete develops. The spirochete is, then, the microgamete, or male gamete. The other half of the sporozoite, mentioned above, leaves the cells and becomes crescentic and later spherical. This spherical body is the perfect female or macrogamete and is ready for fertilization. This act McDonagh has never seen, but he outlines what he considers to be its probable course. If the phenomena which he has observed are correct, then the organism of syphilis is a sporozoon of the class telosporidia, since the spores form at the end of the cycle. He believes that the infection is probably conveyed by the sporozoite or infective granule, and not in the spirochetal stage. This has confirmation in the period of incubation after exposure, during which time the parasite undergoes its development as described. Another confirmatory fact exists in the failure of salvarsan or mercury to sterilize completely the infected subject, although they are both fatal to the spirochetal form of the para-

site. This suggests that the spores are resistant and undergo subsequent development, causing the recurrences and the later manifestations of the disease. These observations have not yet been confirmed.

THE JELLY METHOD now being used in the study of syphilitic secretion hoping to find other stages in the life history of the spirochaeta pallida is described by Jennings, as follows:

"Coefficient jelly" consists of 2 per cent. agar, containing a sufficiency of saline solution to prevent cytolysis; 5 c.c. of this is placed in a test-tube and 0.4 c.c. of Unna's polychrome methylene blue, and 0.4 c.c. of a 5 per cent. solution of sodium bicarbonate in water added; the total bulk of the mixture in the test-tube is then made up to 10 c.c. This jelly is boiled, and when molten a drop is poured on a slide and allowed to spread into a thin film. When cool and set, the blood or pus from a chancre is put on a cover-glass, and this is inverted on the surface of the set jelly. The cells spread out between the cover-slip and jelly, and in a few minutes the leukocytes and parasites begin to stain and can be examined. The parasites appear as small, round, brown-colored bodies lying free in the plasma. Each one contains some deeply staining granules and a vacuole. Besides these, similar bodies are found inclosed within the mononuclear cells. In this situation they show up on the jelly as copper-colored "inclusions," which on careful examination contain a stained structure resembling the spirochete.

Moolgavka has examined 25 chancres and 22 glands by this method and claims to have found certain red bodies in every case of syphilis. The leukocytes and other cells stain blue. He found extra cellular bodies 2 to 10 microns in diameter, containing a granular nucleus and one or two chromatin dots. Other bodies were seen which contained no definite nucleus, but were completely filled with granules, sometimes in violent motion. Intracellular bodies were also found which he be-

lieves are parasites because of their peculiar staining reaction and their development. Up to the present time he has only seen them in syphilitic subjects.

DIFFERENT STRAINS OF SPIROCHETES.—There is much in the history of syphilis and parasyphilis to suggest that certain strains of the *spirochaeta pallida* show a tendency to cause nerve and brain lesions while others attack the bones and viscera more frequently. Erb followed the history of five patients infected from one individual and they all developed ataxia or general paralysis.

SUMMARY.—Syphilis is an infectious disease affecting the entire organism and is produced by the *treponema pallida*. It may be acquired or inherited. Acquired syphilis begins as a more or less characteristic lesion known as hard chancre. The disease gradually spreads throughout the body and may attack any part of it, and alter the course of any coincident disease or imitate almost any. The cause of lues, the *spirochaeta pallida*, was discovered in 1905 by Schaudinn and Hoffmann. This organism is a very slender, spiral-shaped, motile organism from 8 to 14 micro-millimeters in length and about one-half a micro-millimeter or less in thickness; its curves are abrupt and very regular and fine. While actively motile it does not run across the field as do other spirochetes. Staining methods for demonstrating the *spirochaeta pallida* are very unsatisfactory. By far the best method of finding it is by dark field illumination. The chancre is washed, squeezed and wiped free from the first secretion, 5 minutes are allowed to elapse, then the secretion which collects upon the sore is placed on a slide and sealed under a cover glass with melted paraffin. With 1-12 oil-immersion lens, the *spirochaeta pallida* is seen as a silvery, curly motile organism in the dark field. Negative findings are unreliable, as are apparently positive ones if the secretion comes from a lesion.

the mouth. We consider all specimens negative when smears show the organisms well stained with methylene blue, even though the living spirochete may look more or less typical. Noguchi has succeeded in cultivating the *spirochaeta pallida* in pure culture. A number of observers now believe this spirochete is only a stage of the life cycle of this organism. Other stages may be discovered. We also believe certain strains of spirochetes show a preference for the nervous system.

## CHAPTER XXVIII.

## SYPHILIS

MODE OF INFECTION, CHANCRE, TYPES OF CHANCRE, GLANDULAR ENLARGEMENT, DIAGNOSIS, SKIN ERUPTIONS, STAGES OF SYPHILIS, SYPHILODERMATA, MACULAR SYPHILIDE, PAPULAR SYPHILIDE, MUCOUS PATCH, SYPHILIDES, PATHOLOGY

MODE OF INFECTION.—Syphilis is, as a rule, contracted during sexual intercourse or inherited, although it may be acquired by contact with some mediate substance bearing the spirochetes. The delicate quasi-mucous membrane of the prepuce and glans penis, or any abraded surface on the genitals or integument, afford easy entrance for the germs. Sexual perversion is responsible, in most of the patients, for the chancres of the rectum and tonsil, and kissing is a prolific source of infection of the mouth, tongue and lips. Surgeons may acquire it in operating upon syphilitic patients or in making vaginal examinations in unsuspected cases where the examiner has a hang nail or an abrasion on the finger. Chancres or mucous patches of the breast of a wet nurse may infect the nursing baby.

Among the many things which may convey syphilis are drinking glasses, knives, forks, spoons, cigars, pipes, glass-makers' blow pipes and musical instruments. Catheterization, cupping, tattooing, skin grafting and ritual circumcision also may convey syphilis.

THE CHANCRE.—The lesion which forms at the point of infection is known as a chancre or initial lesion. It begins usually as a small papule which may or may not ulcerate.

Chancres are generally single, and if multiple are so from the beginning or very soon after. There is very little soreness or inflammatory reaction around the lesion, and on account of this



Figure 94.—Large ulcerated Hunterian chancre. (Kaposi.)

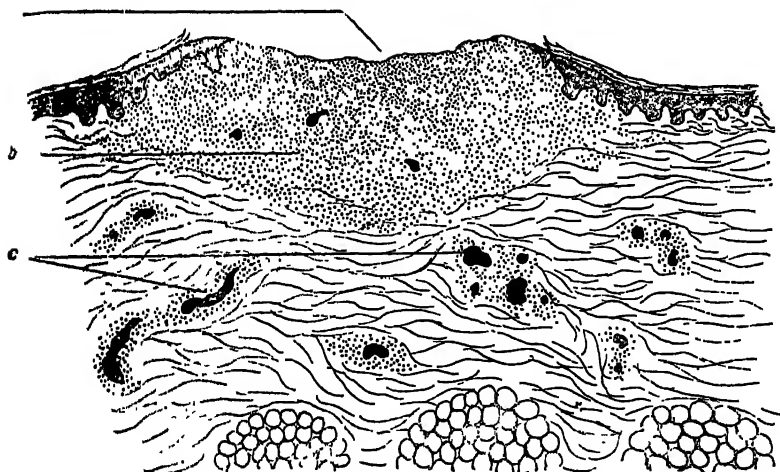


Figure 95.—Pathology of the ulcerated chancre or ulcerated syphilitic tubercle (Linggrammatic). The induration (a, b) is deep seated. The ulcer (a) has destroyed the skin and will leave a scar. The infiltration follows the vessels (c) beyond the lesion. (Keyes.)

it may be overlooked at first. The average period between infection and the appearance of the lesion is from two to four weeks, but in rare instances may be as long as 70 to 80 days.

As the chancre develops it becomes hard and brawny and by about the tenth day this induration, which is almost characteristic of syphilis, may be detected by rolling the lesion between the fingers. The inguinal glands gradually become enlarged in a chain in each groin, if the initial sore is on the penis—otherwise the glands connecting the infected part are affected. The chancre is not auto-inoculable and is usually a clean, innocent looking sore. It, at times, may have a silvery, scaly appearance. The edges of the ulcerated chancre are sloping instead of abrupt or undermined, as in the chancroid, and the base is smooth, red and shining. Ulceration caused by secondary infection may change the typical appearance of a chancre as, of course, does double infection with chancroid and syphilis. The chancre has very little or no inflammation around it, and the induration ends abruptly with a well defined margin. The secretion is serous in character unless irritated or secondarily infected.

Chancres are multiple in from 10 to 20 per cent. of the cases; their development is generally synchronous but may be successive. In the latter mode of development only a short interval elapses after the first lesion until the others appear, while with chancroid auto-inoculation may take place at any stage of the sore.

After healing has taken place very little scar is left.

**TYPES OF CHANCRE.**—There are several types of chancres which are discussed below in the order of their importance and frequency.

**THE ERODED CHANCRE** is, according to Keyes, the form assumed in from 60 to 80 per cent. of the lesions. The eroded surface is smooth and polished, and may be slightly elevated or a trifle depressed; there is a slight sero-purulent discharge; the induration is rounded, circumscribed and thin. Sometimes the



infiltration is like a "thin resilient disk" under the skin, and is then called parchment chancre.

THE ULCERATED CHANCRE is the typical Hunterian chancre and consists of a comparatively large amount of induration which interferes with the circulation and produces a true ulceration of the derma. The edges are sloping and the base is clean and granulating, or covered by a false membrane. It is the clinical picture of a neoplasm eaten out by the ulcer, not that of an ulcer surrounded by an inflammatory ring.



Figure 96.—Chancre of the lip. (White & Martin.)

THE INDURATED PAPULE is of infrequent occurrence and is a small, flat, dark-red papule, which eventually becomes scaly as it begins to heal.

RARER VARIETIES OF CHANCRES are those in the form of a group of superficial ulcerations, resembling herpes, and the so-called "silver patch" of thickened epithelium which occurs only on the glans penis.

INFECTING BALANITIS is still another variety in which the initial lesion is diffuse and thickened over a broad but not clearly defined area; the surface has a velvety excoriated appearance.

Occasionally a chancre assumes a ring-like form, the margins being more infiltrated than the center; it is then called annular chancre.

CHANCRE REDUX OF RELAPSING INDURATION is an indolent lesion very similar to a chancre, which may occur at the original site of the initial lesion and be mistaken for a second infection.

INDURATING EDEMA, according to Taylor, begins as a painless induration around the chancre and extends in a phlegmatic manner until considerable area is involved; the swelling is not like inflammatory engorgement or ordinary edema, but the invaded tissues have a hard, smooth, dense feeling like bone or cartilage. There is no pitting on pressure, no tenderness or pain, and the parts have a dull brick-red or purplish hue. When fully developed it may remain for months in this indolent condition unless treated by intramuscular injections of mercury or salvarsan.

LOCATION:—Chancres are classed as genital or extra-genital, according to their location. The most frequent seats of the genital lesions are the corona, the frenum and the fossa on each side of it, the inner surface of the prepuce, the glans, the meatus and the skin surface of the shaft of the penis. Chancres of the urethra and scrotum are not so common. Extra-genital chancres may appear over any part of the integument or mucous membrane where the virus happens to become inoculated, especially on the lips, eyelids, tongue, gums, tonsils and nose. Chancres of the fingers occur most commonly in physicians, surgeons, dentists, midwives and nurses. When on the finger they are usually excoriated or ulcerated nodules, with-

out inflammatory symptoms, or perhaps the typical induration of syphilis. In women the genital chancre is usually on the vulva, os uteri or just within the vagina, and is more irregular and less typical, as a rule, than chancre in men.

GLANDULAR ENLARGEMENT.—The syphilitic virus is conveyed from the local lesion through the lymphatic channels into the general blood circulation. The glands act as filters to check, momentarily, the infection and later seem to act as storehouses for the *spirochaeta pallida* during the secondary stage. The glands in anatomical connection with the lymphatics leading from the chancre are the first to become involved. This occurs about the fourth or fifth week after the infection. The first involved are usually the inguinal, axillary or submaxillary, and later all the lymphatic glands throughout the body become enlarged. They are firm, hard, non-inflammatory, freely movable, painless and rarely suppurate. The lymphatic vessels leading to the glands may become indurated and feel like "hard cords."

DIAGNOSIS.—Although frequently typical and easily diagnosed, syphilitic lesions may be very confusing, and prudence and discretion should always be exercised in considering the past history and all the symptoms before reaching a conclusion as an error in the diagnosis is particularly harmful. The chancre has certain distinctive features, which, when found, should suggest the nature of the lesion, but unless the *spirochaeta pallid* can be demonstrated or unless the individual from whom the disease was contracted can be examined and found to be syphilitic, a positive diagnosis should be withheld until the appearance of a positive Wassermann reaction or the development of the secondary eruption on the skin. The initial lesion is characterized by the following symptoms: it has an incubation of about three weeks; begins as a papule which may ulcer

ate, but does not form a pustule; is single or multiple from the start; is shallow, scooped out, flat or elevated, with sloping or rounded edges; the floor is red and clean looking and exudes a scanty serous secretion which is not auto-inoculable; the lesion has firm, hard induration around and beneath it, and is free from pain or inflammatory symptoms unless secondarily infected; the lymphatic glands are enlarged in a chain, in each groin (if the sore is on the penis), and are not adherent to the overlying skin, and infrequently suppurate. (See Chancreoid.)

SKIN ERUPTION appears about the sixth week after the chancre, as macules, papules or pustules and may progress to the various syphilides to be described; they do not itch or cause any pain and may occur on any part of the body. They are frequently found where simple skin eruptions seldom or never occur. There are usually nocturnal pains in the bones, and especially the long bones, as the tibia and ribs and in the vertex of the cranium. Fever is present at the beginning of the secondary stage, but is, as a rule, slight, except with debilitated subjects. Pharyngitis is likely to occur early and is of a diffuse erythematous type. Mucous patches are found about the muco-cutaneous margins, in the mouth, vagina, or under the female breasts. They appear first as white patches on the mucous membrane, which soon form shallow, well defined ulcers. These may hypertrophy and form elevations or cauliflower-like granulations, called condylomata. The hair may fall out in patches, or diffusely merely leaving it thin. The nails and skin around them may be affected. The late or tertiary lesions extend deeply, break down and destroy considerable tissue, and may produce large ulcerations. Any of the organs of the body may be attacked by syphilis with symptoms varying according to the character and location of the lesion.



Figure 97.—Extra genital chancre of three weeks' duration. (M. B. Hutchins.)

**DIFFERENT STAGES OF SYPHILIS.**—Clinically, syphilis is divided into three stages, primary, secondary and tertiary.

**THE PRIMARY** stage is the period between the appearance of the initial lesion and the skin eruption; the average duration of this stage is about forty days, but is very variable and may be shorter or much longer. It is characterized by chancre and local lymphatic adenopathy.

**IN THE SECONDARY STAGE** there are skin eruption, sore throat, lassitude, pains in the muscles and bones, headache worse at night, falling out of the hair, mucous patches, general lymphatic enlargement, syphilitic fever, etc. The duration of this stage is more variable than the primary and depends largely upon the treatment; it may last 12 to 18 months or longer.

**THE TERTIARY STAGE** follows the secondary in a most uncertain, irregular manner, and is characterized by gummatous formations in the deeper structures and organs of the body. Occasionally, tertiary lesions may be precocious and appear during the third or fourth month after the infection.

**SYMPTOMS OF THE SECONDARY STAGE.**—There is a wide variation in the amount of disturbance throughout the general system during the secondary stage. There is usually a slight rise in the temperature, but it may pass unnoticed, or be mistaken for malaria or biliousness. The fever is usually highest at the beginning of the cutaneous eruption and may decline gradually or cease abruptly, but may return again at any stage of the disease. The skin eruption generally appears about the sixth week after the initial lesion and presents three notable characteristics: polymorphism, round cell infiltration, and no itching. The early eruptions are distributed widely over the

body and are superficial, while the latter ones, as a rule, are less extensive but deeper. The lesions are not inflammatory and are free from pain. The occurrence of macules and papules or portules, simultaneously, is called polymorphism, is a common feature of syphilis, and is important from the point



Figure 98.--Erythematous syphilide. (Fox.)

of diagnosis. The lesions often show a tendency to form circular patches or curved lines. The color is usually a brownish red and is often compared to copper or raw ham; this color is finally more permanent in the later lesions, and cannot be made

to disappear by pressure as can the earlier ones. The syphilides occur on any part of the integument, the macular eruption usually sparing the head, hands and feet. The hair may fall out, diffusely or in patches; the eyebrows, beard and hair in the pubic or axillary region may be involved, as well as the scalp. There are pains in the muscles and bones, which are worse at night. The inguinal post auricular, post-cervical and epitrochlear lymphatic glands become enlarged. Mucous patches form in the mouth and also on the anus or genital. Tonsilitis or pharyngitis is a very common symptom and is particularly persistent in smokers; ulcerations may appear on the tonsils or pharynx. Jaundice, albuminuria and enlargement of the spleen may sometimes be present; "syphilitic cachexia," characterized by emaciation, pallor, loss of appetite, nervousness, etc., may be observed occasionally in the secondary or tertiary stage. Symptoms closely resembling typhoid fever may occur in weak, ill-conditioned patients early in the secondary periods.

**SYPHILODERMATA.**—The cutaneous manifestations of syphilis may be classed as macules, papules, pustules, gummata, bullae, rupia, tubercles and ulcers.

**THE MACULAR SYPHILIDE, EXANTHEMATOUS SYPHILIDE, ERYTHEMATOUS SYPHILIDE OR SYPHILITIC ROSEOLA** is usually the initial form of the eruption and consists of small pink or reddish spots with little or no elevation or scaling. They appear first on the abdomen, loins and chest, and vary in severity, from those that are barely distinguishable or only give the skin a mottled appearance, to conditions where the entire body becomes almost covered with the smooth, flat, reddish-pink patches. These lesions are not attended with itching or inflammation of the skin. The macular eruption may gradually assume the papular form. It may be mistaken for tinea versicolor, pityriasis rosea, scarlatina, measles, drug eruptions, urticaria, and erythema.



Brownish-yellow pigmented spots may occur on the neck around the forehead and upper shoulders, during the first year or two and remain for months unchanged. Whitish spots may form in them after the eruption has lasted a considerable time and may be mistaken for leucoderma. Untreated, the initial roseola lasts from two to six weeks, but if properly treated clears up promptly.



Figure 99.—Large flat papular syphilide. (White & Martin.)

**PAPULAR SYPHILIDE.**—In this form the lesions appear as small elevations. They usually occur in groups and are firm, dull red and circumscribed. They make their appearance, as a rule, within the first six months of the disease. There are small and large acuminate papules, and small and large flat papules. They begin on the face and neck, or over the

body, and attain their full development in about two or three weeks. Some of them may be converted into pustules or vesicles, after which, small scales or scabs may form upon their apices. This is a very chronic form of eruption and requires local and general treatment to dissipate it. The loss of epithelium may produce moist papules, whose secretion is highly contagious. These lesions are produced usually by moisture and friction and occur during the secondary stage. The common situation is around the anus and about the genitals—especially in women—the corners of the mouth, between the toes and fingers and beneath pendulous breasts of women. Moist papules vary in size from a pea to a half dollar, and have a grayish-white, moist surface from which secretion may be expressed containing the *treponema pallida* in large numbers. Under suitable conditions of filth and irritating discharges, they may become hypertrophic, forming the so-called condylomata, or warty papillomatous or vegetating syphilides.

THE MUCOUS PATCH is a lesion somewhat similar to the moist papule, except that it occurs on the mucous membranes. Mucous patches are especially likely to occur on the lips, in the mouth, on the vulva and on the mucous membrane of the anus. The tongue, uvula, tonsils and gums are also frequently the site of such lesions. They have a sodden, grayish-white color, or may be covered by a thin membranous coating which, when detached, leaves a raw-looking surface. Later this erosion may become more deeply invaded and ulceration result.

The diagnosis of the miliary papular form is to be based upon the distribution and extent of the eruption, the color, the tendency to group and to form aggregations, and the presence usually of some lesions with pustular summits, often scattered, minute pustules and occasionally a few large papules and pustules. (Stelwagon). The flat papular syphiloderm is characterized by various sizes of brownish or copper-colored, indu-

rated, flattened papules which are distributed generally over the body. The papulo-squamous form should be distinguished from psoriasis and eczema. The effect of a treatment and collateral evidence may be necessary in reaching a diagnosis of the obscure forms of papular syphilis.

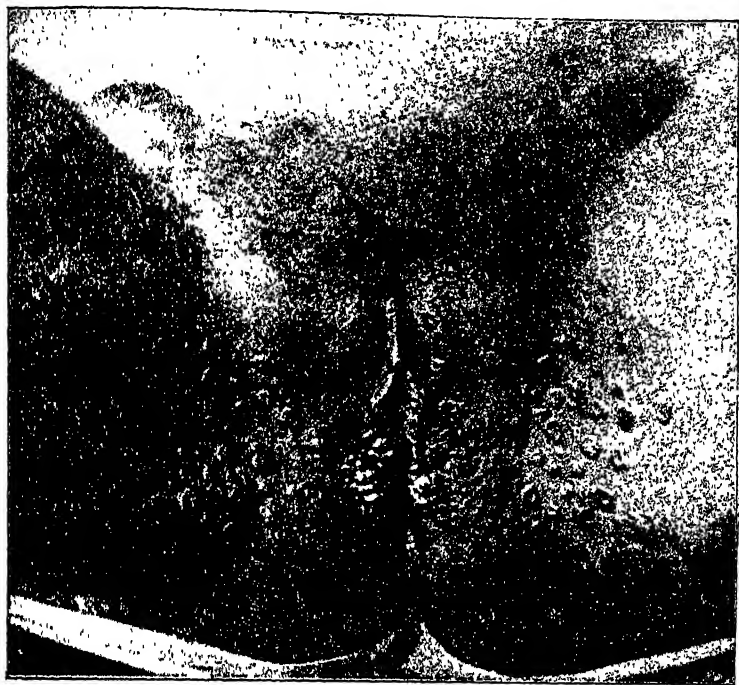


Figure 100.—Vegetations and mucous patches about the vulva. (White & Martin.)

THE PUSTULAR SYPHILIDE is less frequently encountered than the macular and papular syphilide; it may occur at any stage of the disease, but usually in debilitated patients. The pustules vary in size from very small ones to those the size of a dime, and show a tendency to occur where hair and sebaceous follicles are plentiful. They contain only a small quantity of pus, but have a distinctly indurated base. The acneiform syphilide is very similar to acne vulgaris. The history, age and

appearance should be considered in making the diagnosis. Acne is more chronic in its course, less widely disseminated and is essentially pustular, while the pustular syphilide will show an admixture of papules.

THE SQUAMOUS SYPHILIDE occurs in two forms, the diffuse and the circinate eruption. The character of the lesions is the same in both. The squamous syphilides are slightly elevated, have a deep color and are covered with fine white scales which are not overlapping nor silvery gray as in true psoriasis.

THE RUPIAL SYPHILIDE is one of the most characteristic of all the syphilitic cutaneous lesions. The secretion forms a greenish-brown scab; ulceration goes on under this crust, gradually raising it and extending a little beyond its periphery. This process is repeated until there is the typical rupia, distinctly larger at its base than its apex and with the characteristic stratified appearance.

THE GUMMATOUS AND TUBERCULAR SYPHILIDES are late and deep cutaneous manifestations of syphilis, the gummatus being deeper and involving more subcutaneous tissue than the tubercular, which is about midway between a papule and a gumma. These may or may not ulcerate; in the former case extensive destruction may make a very serious condition of the tubercular syphilide. (This is called tubercular because of its beginning as tubercles, not on account of its having anything to do with tuberculosis or tubercle bacilli.) The gummatus syphilides are painless, hard, indolent masses, which undergo softening, leaving an indolent, foul-smelling, irregular, necrotic ulcer.

**PATHOLOGY.**—Syphilitic lesions resemble in many respects those of tubercular origin, being of the infective granulo-

matous type. They are characterized by an early and persistent involvement of the blood vessels and a tendency to the slow production of connective tissue. Furthermore there is a distinctive, circumscribed collection of cells known as gummata; these being poorly supplied with blood vessels and readily undergo tissue necrosis. The blood vessels may become thickened or

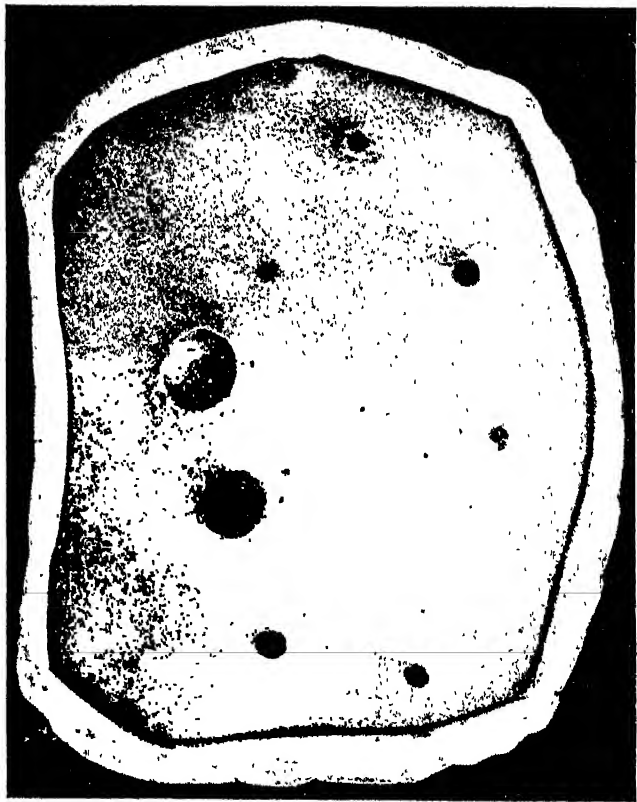


Figure 101.—Rupia. (Museum, St. Louis.) (Keyes.)

obliterated by endarteritis. The induration of the chancre is due to the infiltration of small round cells and leukocytes and also to a proliferation of connective tissue cells, all of which show a tendency to degeneration. This infiltration is distinct

in the blood vessels and in the lymph spaces around them. The lymphatics, leading from the chancre, are always involved and this is especially marked in the nearest glands and later affects the lymphnodes throughout the body. Small gummata, greatly resembling miliary tubercles, consist of a mass of small spheroidal and epitheloid cells, and occasionally giant cells. Taylor describes the larger gummata as having a rather characteristic gross appearance, as follows: "To the naked eye they appear as grayish-white, rather firm, spherical nodules; they generally have a firm, cheesy center and a translucent pearly capsule merging into the surrounding tissue. In structure such a gumma has a granular necrotic center surrounded by a connective tissue envelope which is generally infiltrated with small round cells; when situated in the viscera gummata are quite sharply circumscribed."

**SUMMARY.**—Chancres or initial lesions are the local manifestations at the site of the infection with the spirochaeta pallida. They are usually single or multiple from the start; there is well defined induration which extends beyond the area of ulceration; the incubation period is about twenty-one days; the lymphatic glands in anatomic connection are enlarged, but not inflamed as are those caused by chancroid, unless secondary infection exists; it is often a clean, innocent looking sore, with sloping not undermined edges, and gives off a secretion. The spirochaeta pallida is found by the dark field illumination in the secretion expressed, which proves the diagnosis.

**SECONDARY SYMPTOMS** appear about six weeks after the chancre and consist of fever, malaise, "biliousness," an eruption on the skin of macules, papules or pustules, mucous patches, alopecia, nocturnal pains, and nocturnal headache, pharyngitis, and tonsillitis, with or without ulceration. These lesions gradually develop after the sixth week and may come singly

or in various combinations; or they may be so slight as to be overlooked entirely by the patient. The macular syphilide usually appears on the abdomen, loins, chest and thigh as small pink or reddish spots with little or no elevation or scaling. The papular syphilide consists of small, dull red, elevated lesions or large flat papules. The mucous patch is similar to the papular syphilide except that they occur on the mucous membrane. They have a sodden, grayish-white appearance and may ulcerate. Pustules are less frequently encountered. Gummatous syphilides are painless, hard, indolent masses which undergo necrotic changes and leave indolent irregular ulcerations. Pathologically, syphilitic lesions resemble in many respects those of tubercular origin. They are characterized by an early and persistent involvement of the blood vessels and a tendency to the slow production of connective tissue.

## CHAPTER XXIX

## VISCERAL SYPHILIS AND HEREDITARY SYPHILIS

PATHOLOGY, SYMPTOMS, DIAGNOSIS, PROGNOSIS, TREATMENT OF  
SYPHILIS OF THE NOSE, PALATE, TONGUE, LIVER, EPIDIDYMIS  
AND TESTICLE, BONES AND FINGERS, CEREBRAL SYPHILIS,  
SYPHILIS OF SPINAL CORD, AND SUMMARY

**SYPHILIS OF THE NOSE.**—Chancre of the nose is rare, but is occasionally observed. Secondary affections of the nose usually occur as a coryza or a mucous patch. The tertiary lesions are more important and may involve any part of the nasal cavity, the septum, however, most frequently is implicated. Superficial or deep gummata may develop and gradually involve the surrounding tissue. They finally become necrotic and may result in much deformity. The symptoms vary widely according to the location and extent of the lesion and should be diagnosed from a deflected septum, sarcoma, or ozena, if it has reached the stage of ulceration. There is a most disagreeable odor after the gumma has broken down, especially if caries of the bone has occurred. The bridge of the nose may sink down and the characteristic "saddle" nose or flattened appearance may be produced. The falling in of the nose is not due to the breaking down of the septum (which may be removed), but to secondary fibrous contraction. (Stirling). Mild cases properly treated respond promptly and may be cured, but if necrosis of the bones has begun, the prognosis is less favorable, especially if the damage has already caused deformity.

"Snuffles" is an early and characteristic symptom of hereditary syphilis. The nasal passages are encroached upon by the hypertrophy of the mucous membrane and thus interferes with



nasal breathing. Later the discharge becomes profuse and excoriates the upper lip.

**THE PALATE.**—Both the hard and the soft palate may be infiltrated by gummatous lesions. As the gumma progresses it softens, produces an ulcer and may rapidly produce a perforation. Diffuse syphilitic inflammation of the palate may arise suddenly and do irreparable damage in a very short time. Here salvarsan is always indicated whether one wishes to employ it as a routine or not.

**THE TONGUE.**—Chancre of the lip may readily occur from contact with mucous patches in the mouth of infected individuals, or from spoons, pipes, glasses, etc. It is to be differentiated from cancer, tuberculosis and injury. The history, Wassermann reaction, search for tubercle bacilli and subsequent development of secondary symptoms usually clear the diagnosis. Mucous patches occur very frequently upon the tongue during the secondary period. They begin as small, painless, grayish white patches covered with thickened epithelium. Later they may become elevated and hypertrophied or develop into erosions or true and painful ulcerations. They occur any time during the first two or three years and often begin with the early secondary manifestations. They should be differentiated from aphthous patches which have more of a yellow appearance and show more evidence of inflammation. Hydroa may be mistaken for mucous syphilides; the former appears as papules or vesicles and the skin eruption does not resemble the syphilide. Herpes, from gastro-intestinal disturbance or ill health, may be mistaken for mucous patches unless the history and coincident or previous symptoms are considered. **ALL PATIENTS SHOULD BE WARNED OF THE DANGER OF SPREADING SYPHILIS FROM MUCOUS PATCHES.** Bald patches free from the filiform papillae, may arise on the anterior portion of the tongue

or the papillae may hypertrophy. Leukoplakia also not infrequently is seen on the tongue and appears as whitish, glassy patches of thickened epithelium.

Superficial or deep sclerosing inflammation may attack the tongue. The former condition is a "lamellated induration analogous to the parchment induration of the chancre." The latter is at first a parenchymatous hypertrophy of the tongue with distinct lobulations on its surface and imprints of the teeth on its margins, but later atrophy and contraction results. Superficial or deep gummata frequently develop in the tongue as painless tumors and may follow about the same course as do gummata in other parts of the body. Diagnosis from cancer and tuberculosis may be difficult and may require a therapeutic test with anti-syphilitic treatment before a positive conclusion can be reached.

The pharynx is one of the most common seats of secondary and tertiary lesions and especially if the throat is irritated by excessive smoking or by the use of alcohol; there is redness, swelling and ulceration of the mucosa, the later condition sometimes being found on the vocal cords.

The tertiary lesions are deep ulcerations, gummata or caries. Healing after destructive process in the larynx may cause distortion or stenosis. Tertiary syphilis may attack the lungs and cannot be differentiated from tuberculosis except by the history; both, however, may be present in the same individual.

**SYPHILIS OF THE LIVER.**—This may occur in the secondary stage, as shown by a mild jaundice, or it may exist as a tertiary manifestation. The liver is affected more often than any other abdominal organ. The tertiary affections, according to Osler, may be: (1) Diffuse syphilitic hepatitis, with gray- or whitish spots and lines produced by tiny areas of round-cell infiltration and connective tissue-hyperplasia. (2) Gum-

mata. (3) Syphilis of Glisson's capsule, which is really an interstitial hepatitis. The symptoms of the liver involvement may be so slight that no attention is called to it or it may cause a feeling of fullness or pain. The liver may be found nodular or lumpy and may extend well below the costal margin, the left portion usually being more enlarged than the right. There are indigestion, ascites and loss of weight. The diagnosis is important, and in case of doubt anti-syphilitic treatment should be tried.

SYPHILIS OF THE EPIDIDYMIS AND TESTICLE.—Late in the secondary and in the tertiary stages small painless lumps may appear in the epididymis, which increase in size and finally become transformed into caseated, gummatous material or fibrous tissue. Resolution may take place under appropriate treatment. It should be differentiated from tubercular and chronic gonorrhoeal epididymitis. Syphilitic enlargement of the testes begins in the tertiary stage as small, hard, painless enlargements which may reach the size of a fist. This is sometimes called sarcocoele. It should be diagnosed from a tense hydrocele with thick walls, from carcinoma, sarcoma and tuberculosis.

SYPHILITIC LESIONS OF THE BONES are more common in the tertiary stage and in hereditary syphilis; they usually occur late in the disease and manifest themselves as osteoperiostitis, osteitis, osteomyelitis and gummatous involvement of the bone. Localized swellings on the bones are called exostoses or periostoses. Periostitis is prone to attack the superficial bones, as the tibia, ulna, clavicle, cranium and sternum, but any of the bones may be affected. Vague aching, boring or neuralgic like pains may occur and are called osteocopic pains. They are usually most marked in the early secondary period, and are found most frequently in the superficial bones, such as the tibia, sternum, ribs and bones of the skull.

Gummatous osteoperiostitis and osteomyelitis are most likely to affect the long bones, the cranial bones, the fingers and toes. Necrosis and softening may occur, be mistaken for a cold abscess, and may leave a chronic ulceration.

THE RADIOGRAPHIC DIAGNOSIS OF SYPHILIS OF THE BONES.—The radiographic features of syphilis of the bones and joints are quite characteristic and deserve much wider diagnostic application than they are at present accorded. Brickner has furnished a valuable description of these bone lesions, and the following consists essentially of his own descriptions:

SYPHILIS of the bones is essentially a productive inflammation of the periosteum alone or of the periosteum and the bone itself. Two reactions characterize the radiographic picture. The most constant and most distinctive feature is thickening of the periosteum. The second and next most important feature is the thickening of the bony tissue, especially the cortex. Both of these produce black shadows in the radiogram. A third type of process, which may appear, by contrast, as a light area, is gummatous destruction of the bone.

THE PERIOSTITIS may appear as a localized shadow or in scattered areas, or it may cover the entire length of the diaphysis. It may appear over a circumscribed surface of the bone or, very often, it develops circumferentially. The shadow may be narrow, fairly paralleling the border of the corticalis and "periostitis simplex luetica," or it may be broad and irregular; but in whatever form it appears its outline is distinct. (Contrast Periosteal Sarcoma.)

Syphilitic periostitis begins next to the bone, as a subperiosteal infiltration. In an early stage, therefore, the radiogram may show the periosteal shadow. As the inflammatory process

advances the periostitis and its X-ray shadow increases, often as the predominating lesion. It may thus acquire considerable density, as in the localized "periostitis gummosa." If a periosteal gumma produces a palpable mass, the bulk of this mass, being only inflammatory, may cause no shadow on the plate.

A periosteal gumma may break down at the site where the inflammatory process is most active, viz., subperiosteally. The reaction more often, however, takes the form of ossification—also beginning in the deepest layer, the periosteal shadow then acquiring the density of bone shadow. In the ossifying process, the periosteum and cortex may fuse into a bony mass, appearing in the picture as a uniformly dense, structureless, shadow-ossifying periostitis.

OSTEITIS.—While in some cases of bone syphilis, notably in the early stages, the radiograph shows only characteristic periostitis, in most there develops, or is seen at the outset, an also characteristic osteitis, marked by thickening of the substantia corticalis or of both the compacta and spongiosa. The process may be localized, or diffuse. The overgrowth of cortical bone may extend only externally or, internally, encroaching on or obliterating the medulla; or both externally and internally, sometimes as a symmetrical fusiform enlargement. At the site of the osteitis the bone becomes denser, sclerosis producing a correspondingly denser shadow, in which the bone structure is lost. The ossifying process may involve the periosteum, fusing the bone and bone covering into a solid mass, as above described. In long-standing cases the overgrowth of bone in its axial direction produces the elongation and bowing of the shaft described by Fournier, which is also characteristic of syphilis.

GUMMATA within the bones, instead of resolving, may go on to bone destruction and thus produce light areas in the radiogram; but these are surrounded by dark shadows of reactive bone thickening, which quite distinguishes them from the light areas of bone absorption seen in radiograms of osseous tumors and tuberculosis. The plate will also reveal thickened bone substance and periostitis. Gummata are usually single in a bone, but sometimes multiple or confluent. They may be very small or involve enough of the bone thickness to cause pathological fracture. Occasionally the gumma surrounds an island of bone, causing it to appear in the radiograph as a sequestrum. But the sequestrum formation is unusual in unimixed syphilitic osteomyelitis, which also contrasts it with tuberculous and pyogenic osteomyelitis. The osteo-chondritis of hereditary syphilis, which may be the only lesion found in fetuses, and which is sometimes accompanied, in infants, by pseudo-paralysis, also produces characteristic X-ray pictures, as demonstrated by Carl Hoehsinger. He found in fetuses and infants the following radiographic features: Marked thickening of the epiphyseal and the diaphysis, the border of which appears very jagged instead of smooth; periostitis over the epiphyseal end of the diaphysis; the shadow varying in density in proportion to the deposit of osteophytes; irregular absorption of bone within the epiphyseal end of the diaphysis; the area of the epiphyseal cartilage much widened and with jagged borders; and a shadow of callus formation if there has been epiphyseal separation.

DACTYLITIS SPINA-VENTOSA in hereditary syphilis, essentially an osteo-chondritis, is notoriously difficult to distinguish, by its outward appearance alone, from tuberculous dactylitis. Although the radiogram occasionally shows borderline conditions of doubtful interpretation, it will usually establish the correct diagnosis. Ware has set forth with special clearness

the contrasting radiographic features of hereditary luetic and tuberculous dactylitis: "Tuberculosis originates in the epiphysis, syphilis in the epiphyseal end of the diaphysis. In tuberculosis there is little or no periosteal thickening, in syphilis the periostitis is marked. In tuberculosis there is a greater tendency to bone destruction, in syphilis to bone production. In tuberculosis the swelling is largely due to inflammation of the soft parts, in syphilis it is largely due to thickening of the bone. Suppurating sinuses are not uncommon in tuberculosis dactylitis, they are in syphilitic dactylitis. Multiple dactylitis is usually not tuberculous, it may be syphilitic or rachitic. In rachitis, where the pathological changes are also most active at the epiphyseal line, the X-ray generally shows a cup-shaped effect of the epiphyseal parts.

JOINT SYPHILIS is more difficult to diagnosticate radiographically than syphilis of the bone shaft, partly, perhaps, because, being common, one sees too few skiagrams of luetic arthritis to formulate their minuter features, and partly because joint syphilis not infrequently is an inflammation of the soft parts rather than of the osseous tissues. When the latter are clearly invaded, however, they produce the same characteristics as seen in the X-ray examinations of syphilis of the shaft. In luetic arthritis, then, we note periosteal involvement and bone production. In tuberculous arthritis periostitis is absent or slight, and the bone shows irregular destruction, rather than production or mere rarefaction. Gumma of the articular end of a bone is recognizable in the picture. Destruction of the articular surface by gummous chondritis is, Brickner believes, less easily distinguished. The terminal appearance of a syphilitic arthritis may much resemble, radiographically, that of an arthritis deformans.

In these cases, unless the picture bears the distinctive earmarks of bone syphilis, it is best to —

balancing the radiographic with the clinical findings. Bilaterality of an arthritis or synovitis speaks for syphilis rather than tuberculosis. The anamnesis, the presence or absence of other syphilitic lesions and the reaction to the Wassermann test cannot here be ignored.

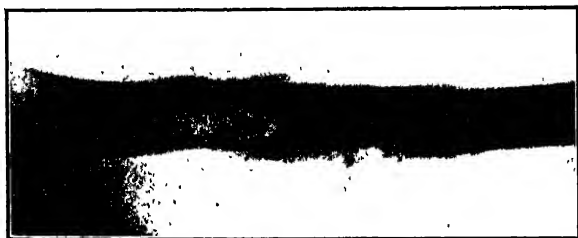


Figure 102.—Gumma of Humerus. (Brickner.)

Osteo-porosis, sclerosis, and caries are the end products of syphilitic, as of all other infections of the bones. When they are irregularly distributed in an advanced lesion, it may be very difficult to distinguish, radiographically, luetic osteomyelitis from chronic osteomyelitis of pyogenic origin.

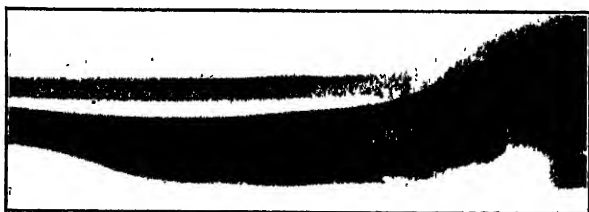


Figure 103.—Old Syphilitic Osteo-Periostitis of Tibia. (Brickner.)

**SYPHILIS OF THE FINGERS.**—**DACTYLITIS SYPHILITICA** may occur in both acquired and hereditary syphilis and may arise either in the bones and periosteum or in the subcutaneous connective tissue. The former begins as a slight enlargement and gradually increases in size and becomes hard. It is usually painless and may remain in an indolent condition for many months and finally be absorbed or break down and discharge through a sinus. The joints are finally attacked; a destruc-



tive arthritis may follow and end in the ankylosis of the joint or the formation of a flail-joint.

Gummatous infiltration of the subcutaneous connective tissue is not so common and also runs a slow, indolent course.

**SYPHILIS OF THE HEART AND BLOOD VESSELS.**—Syphilis may affect any part of the heart, but the muscular walls are more likely to be attacked than the valves. The symptoms are, as might be expected, varied and uncertain, such as headache, dyspnea, vertigo, pain, palpitation, sclerotic arteries and general weakness. Lues is a very common cause of cardiac affections.

Syphilis of the arteries may occur as periarteritis or obliterating endarteritis. The former attacks the cerebral arteries, which may give way at weakened points or where a gumma has broken down, and hemorrhage may occur with results depending upon its location. Obliterating endarteritis is the cause of the deep ulcerations following gummata. The veins are affected somewhat in the same manner as the arteries. Gangrene and spontaneous ulcerations are frequently due to syphilitic affections of the arteries. Syphilis is also a potent factor in the production of aneurysms.

**SYPHYLITIC AORTITIS.**—Longcope has reviewed the literature concerning syphilitic aortitis, and gives his personal observations regarding sixty-three cases in which syphilitic aortitis was proved to exist at autopsy, or in which the diagnosis seemed reasonably sure, from the combination of certain symptoms and signs, with a positive Wassermann reaction during life. His conclusions are that syphilis produces a characteristic lesion of the aorta, which is responsible, as shown by autopsy statistics and the Wassermann reaction, for most aneurisms, about 75 per cent. of cases of aortic insufficiency in adults, many cases of dilation of the aorta, and a certain group of cases of angina

pectoris. The infection of the aorta probably takes place during the secondary stage, and, though the symptoms and signs of syphilitic aortitis with complications may develop within a few months of infection, the process usually remains latent or unrecognized for an average of sixteen to seventeen years. Thus, syphilitic aortitis is probably a common cause for the presence of a positive Wassermann reaction in so-called latent syphilis. The early symptoms and signs of syphilitic aortitis are a positive Wassermann reaction, precordial pain, slight dyspnea, attacks of paroxysmal dyspnea and angina pectoris, cardiac hypertrophy, increased pulsation of the vessels of the neck, and signs of dilatation of the aorta.

Of the entire number of cases reported, twenty were treated with salvarsan. Longscope says that the precordial pain, paroxysmal dyspnea, and angina pectoris are temporarily or permanently relieved by repeated injections of salvarsan, but in certain instances these symptoms, especially after large doses, may be aggravated for the first forty-eight hours after injection. The permanent relief of these symptoms can only be obtained, if at all, by the most persistent treatment. It is necessary, therefore, to give repeated doses of salvarsan or neosalvarsan and supplement this treatment with mercury.

SYPHILIS OF THE CRANIUM AND BRAIN.—Syphilitic otitis or periostitis of the cranium may be diffuse or localized, but does not cause nervous symptoms until the nodules or exostoses press on the underlying meninges and brain tissue; the symptoms vary with the locality of the pressure. The meninges are frequently the seat of syphilitic inflammation and gummatous growths. These may be localized headache, which is aggravated by percussion over the area of affection. The brain tissue itself may be invaded by gummata, which subsequently undergo softening, or by degeneration caused by disease or obliteration of the arteries. The part of the brain involved determines the

character of the symptoms produced just as with any other lesion or tumor. The blood vessels are likely to become partially or completely occluded with consequent lack of nutrition and softening. Degenerative changes in the outer and middle coats of the arteries may so weaken them that they rupture and produce hemorrhage into the brain substance. Hemiplegia in a young person should at once arouse suspicion of syphilis. Basilar meningitis may cause paralysis of one or more of the cranial nerves, especially the ocular and facial. Epileptoid attacks, with either general or local spasms, may be caused by syphilis and readily mistaken for ordinary or Jacksonian epilepsy. General paralysis and paresis are nearly always caused by syphilis. Noguchi and More recently examined the brains of seventy patients who died of general paralysis and paresis and succeeded in demonstrating the spirochaeta pallida in twelve. This tends to support the view that these parasymphilitic affections are caused by the local action of the parasite of syphilis on the brain, and therefore may be regarded as a peculiar form of tertiary syphilis. It is of the greatest importance to begin treatment early and continue it cautiously over a long period in such patients.

Symphilitic nervous affections more frequently occur in men than in women and in those of a neurotic tendency or who have had some other nervous trouble. Various disturbances of speech may occur in the course of syphilis, when the brain is involved.

SYMPHILIS OF THE SPINAL CORD appears as tumors, meningitis or disease of the cord itself, locomotor ataxia. Gummata are generally situated in the meninges of the cord, and if the pressure is on the posterior columns the symptoms are mainly sensory or vasomotor, while if the anterior portion be affected they are paralytic and atrophic. The manifestations of such lesions are slowly but steadily progressive. There is pain in the back, which is increased on pressure or voluntary move-

ments; the back is therefore held rigid. The pains are paroxysmal, shooting or lancinating in character, worse at night and accompanied by numbness, hyperesthesia, twistings, spasms and exaggerated or loss of reflexes.

Hammond thinks there are three distinct ways in which syphilis may produce tabes dorsalis: first, by necrotic degeneration of the posterior columns, caused by the defective nutrition produced by endarteritis, which gradually occludes the vessel; second, by the infiltration of syphilitic material of a gummatous nature into the posterior columns, causing degeneration; third, by the abnormal development of connective tissue, which compresses and destroys the nerve fiber.

THE SYMPTOMS are sharp, shooting pains, loss of knee jerk, inability to stand with the eyes closed and the feet together, sensory disturbances, as numbness of the feet and legs, inability to empty the bladder, obstinate constipation, loss of normal festicular sensation, and finally the ataxic walk. The pupils react to convergence of the eyes, but not to light (Argyll-Robertson pupil.)

Syphilis may affect the nerves in the same manner as it does the brain or cord.

The diseases of the nervous system due to syphilitic tumor growths or gummata and tabes dorsalis in the early stages may be benefitted by treatment, but other conditions, as paralysis from a ruptured blood vessel, syphilitic paralytic dementia, and advanced locomotor ataxia, are only slightly if at all affected by anti-syphilitic treatment.

Investigations have shown that about 90% of the patients with locomotor ataxia have had syphilis. Paraplegia is caused by lues in at least one-half of the cases and paresis probably in every instance.

SYPHILITIC AFFECTIONS OF THE EYE may occur at any stage of the disease from the initial lesion to late involvement

of the ocular nerves. The secondary eruption sometimes appears on the lids and the broken down lesions may form ulcerations. Gummata may appear in the lids and behave as in other localities. Obstruction to the passage of tears down the duct to the nose may be induced by an inflammation of the lachrymal sac—dacryocystitis. Periosteal involvement occasionally arises late in the disease, along the margins of the orbit, and lead to necrosis.

The Cornea is rarely affected in acquired syphilis; diffuse interstitial keratitis, however, is one of the most characteristic symptoms of congenital lues and begins usually between the age of six and puberty. The cornea assumes an opaque, ground-glass appearance, which gradually reduces vision until the patient can scarcely recognize darkness from light. It runs a chronic course from several months to two years, but may clear up entirely or a few macules may persist. Occasionally dense opacities with flattening of the cornea may remain and produce almost permanent loss of sight.

Iritis is frequently caused by syphilis. It is not unlikely to be a part of an inflammation attacking the whole uveal tract and is then specially liable to produce an exudation in both the aqueous and vitreous humors. The iris appears swollen, dull, loses its luster, "becomes greenish in blue or gray irides, and muddy in brown or black varieties." Distinct circumscribed swellings may occur even in the second stage and are always on one edge of the iritis. The pupil is contracted and sluggish in action and on dilation is irregular on account of adhesions to the lens capsule. The subjective symptoms consist of lachrymation, photophobia, interference with vision, and pain, which is often severe and radiates to the orbit, forehead and temple, being decidedly worse during the night. Tertiary syphilis may attack the choroid and retina, but at first has few subjective manifestations except perhaps defective vision. Optic neuritis and optic atrophy may both result from

sypilis. As previously mentioned, the ocular muscles are more frequently paralyzed by sypilis than by any other disease.

Sypilis of the ear may be either acquired or congenital. In its most characteristic form it accompanies interstitial keratitis, and appears in youth as an affection of the inner ear, showing itself chiefly in gradually increasing deafness. Nerve deafness in later life may also be due to an old sypilitic infection. Optic nervitis and ear affections are more likely to follow inadequate courses of salvarsan than if no treatment is administered. (See Neuro-Recurrences.)

THE PROGNOSIS OF SYPHILIS.—As regards the limitation of active sypilitic manifestations, no matter what the stage of the disease, we have ample proof that salvarsan and neosalvarsan in repeated small or medium size doses, supplemented with mercury, will effect this without harm to the patient. Furthermore, a scientific application of these remedies will nearly always enable one to secure not only a clinical cure, but also a lasting, negative Wassermann test, except in late affections of the nervous system and brain.

Never before in the history of sypilis has the prognosis been better than at the present when both physician and patient demand a permanently negative Wassermann test, as well as a clinical cessation of all luetic manifestations.

The physician is criminal who allows his patients to feel secure with an inadequate course of treatment without Wasserman, leutin, or other tests to determine the possibility, or rather probability, of the existence of latent infection. Certainly we must assume that every patient is still sypilitic until tests and have shown that he probably is not. In the past we have the insane asylums with paretics and the nervous clinics paretics by assuming that a few years of mercury and f potash had eradicated the disease. The less potent and inadequate tests were then to blame. Now things

are different and the physician should be considered grossly negligent who does not take advantage of the modern tests to determine the probable cure before the patient is dismissed. We have no reason to assume that less harmful results will follow inadequate courses of salvarsan or neo-salvarsan than resulted from inadequate courses of mercury and iodide of potash. The early hope of physicians and widespread belief of patients that one or two injections of salvarsan would cure syphilis must bear its crop of bad results before we realize fully, as a profession, the painstaking work that is necessary to free the patient from this disease and its hazards. The conscientious syphilologists and alienists realize more fully than do the other specialists and practitioners of medicine the danger of insufficient treatment. The specialists, too, in internal medicine see the result of syphilis on the blood vessels, nerves and other viscera, but often too late. Less praiseworthy is the smug complacency with which a considerable percentage of eye, ear, nose and throat specialists regard their "cures" of eye, ear, nose and throat lesions. The object of many seems solely to heal the local affection, thinking little, if at all, of the ultimate results that follow such half-way measures, not checked by serologic tests. They see these patients late in the disease as most of the affections are tertiary. The physician who treated the original infection has perhaps long since dismissed the patient as probably cured. The eye, ear, nose and throat specialist then sees the still uncured disease, but too frequently thinks only of the local lesion and not of its significance as a serious warning. How many of these specialists treat their syphilitics until the Wassermann remains permanently negative? They boast of the healing quality of iodide of potash. They admit that perhaps half of the lesions they treat are luetic, and yet the serologists assert that iodide of potash has little influence in rendering the blood test negative. When mercury is also administered, its exhibition is carried little beyond the cured symptoms.

Probably the next time the patient is heard from he is in the hands of the neurologist being treated for paresis or tabes and the damage may be already beyond repair. WHO IS TO BLAME?

THE MARRIAGE OF SYPHILITICS.—Luetics should not be allowed to marry until reasonable tests have shown them to be free from syphilis. One or two years should elapse between the apparent cure and marriage—the provocative Wassermann being consistently negative during this interval.

THE ULTIMATE FATE OF THE SYPHILITICS TREATED WITH SALVARSAN, NEO-SALVARSAN AND MERCURY.—Regarding the final outcome of the patients who have been apparently cured of syphilis, and whose Wassermann reactions and tests of the spinal fluid remain negative for a period of several years, nothing absolutely positive can be stated at present. It does seem unreasonable to hope, however, that the metaluetic affections, so prone to follow our older methods, will occur less frequently. Since these affections are produced by the spirochetes it is not unnatural to hope that by affecting a more thorough eradication of the organisms we will thus lessen the late lesions caused by them.

After the administration of injections of salvarsan and neo-salvarsan we are convinced that the continued good health and feeling of well-being experienced by the patients apparently cured with these remedies, and mercury, speak well for the treatment we now recommend. To neglect present and patent ills for fear of those which theoretically might arise in the future, would hardly seem to be a wise policy. While Finger feels that the situation is "balanced between hope and fear" we are inclined to "hope." We believe we are curing syphilis far better now than we have ever done before, and therefore hope



that the ultimate results may show a pro-rata reduction in the harm of syphilis.

SUMMARY.—Syphilis of the nose is very frequently encountered, especially in the tertiary stage. Perforations often follow gummatous processes in this region. The tongue is nearly always affected during the secondary stage with mucous patches and with occasionally gumma in the tertiary stage. The pharynx also almost constantly shows lesions at some time during the secondary period. Syphilis of the liver may occur both in the secondary stage and tertiary stage. Syphilitic enlargement of the epididymis and testicle not infrequently is seen as tertiary lesions. The bones frequently become diseased in tertiary and hereditary syphilis. The X-ray throws valuable light on this phase of the disease.

Syphilis is thought to cause about one-half of the cardiac lesions and is a patent cause of arterio-sclerosis. Any part of the brain or cranium may be involved by secondary, tertiary, or parasyphilis. Paresis is always caused by syphilis and tabes is nearly always of this origin. Many serious eye affections arise from syphilis, peratitis, iritis, uveitis, retinitis and optic neuritis. The ear is not infrequently affected with syphilis. Neuro-recurrences involving the nerves of the eye and ear may follow inadequate courses of salvarsan or neosalvarsan, especially if these remedies alone are administered in the early secondary stage, therefore, administer free and adequate courses, supplemented with mercury and the iodides. Never before in the history of syphilis has the prognosis been better, as both physicians and patients are fast coming to realize the danger of insufficient treatment and late syphilis, and demand a permanently negative Wassermann reaction of the blood and spinal fluid, as well as negative clinical symptoms before considering the disease cured.

## CHAPTER XXX.

## HEREDITARY SYPHILIS

TRANSMISSION OF SYPHILIS HEREDITA TARDA, PATHOLOGY, SYMPTOMS, SKIN ERUPTION, AFFECTIONS OF THE MUCOUS MEMBRANES, KIDNEYS AND TEETH, PROGNOSIS AND SUMMARY

HEREDITARY SYPHILIS.—Lues may be transmitted from the father or mother, or from both, and when thus transmitted is called inherited syphilis. Its severity depends, as a rule, upon the intensity and the recency of the disease in the parents. The likelihood of its transmission is greatly lessened by appropriate treatment of the father before impregnation and of the mother during gestation. Infection of the mother early in pregnancy usually causes syphilis in the offspring. If, however, the mother contracts the disease in the latter months the foetus may or may not be syphilitic. A syphilitic child may be born of a mother who may not show any signs of syphilis during or after pregnancy and she may suckle her child without danger of infection. This is Colles' law (the converse is known as Profeta's law of immunity): "Children may be born of syphilitic parents and remain healthy and present immunity against syphilis which is either absolute or else modifies syphilis so that it runs a very mild course."

More recent studies have shown that the reasons why these facts are true is that both the mother and the baby have syphilis and are apparently immune because the disease already exists and superinfection is impossible. The reason why the disease should at times follow such a modified course has not been explained. The Wassermann reaction is quite frequently positive, and the mother or baby show no other signs of lues.

The transmissive power of the mother is more potent and more prolonged than is that of the father. A father will not infect an infant if insemination takes place during the primary stage and the mother escapes infection.

The following summary of conclusions is claimed by Robt. W. Taylor to be warranted by observations and studies: "The absence of early manifestations in hereditary syphilis is no criterion that the infant is not infected. Spontaneous involution of the diathesis is most rare and can never be asserted. It is not a haphazard accident.

"In many cases the exanthematic manifestations may be wanting, but later specific or dystrophic lesions may show themselves. Treatment of the infected infant should always be promptly begun and persisted in as assiduously as in the adult with the acquired disease.

"Age and treatment tend to cure the child.

"The view that inherited syphilis is at first superficial and later becomes deep and visceral is false, since the whole organism is involved from very early life.

"SYPHILIS HEREDITA TARDA is not exceptional, it may occur about the eighth and twelfth year, or even earlier, and is frequently encountered at all periods up to the thirteenth year of life and perhaps later.'

"The opinion that the birth of one or several heredosyphilitic infants is invariably followed by the procreation of other and later infected children or by constant miscarriages, and that such a mother may become permanently sterile is not warranted by facts, since leucic mothers may give issue to several infected children and by means of active, prolonged treatment and by the lapse of time may be so relieved as to enable them to give birth to seemingly untainted offspring. Such a result is obtainable in most cases if proper care is exercised."

**PATHOLOGY.**—The changes in the foetus resulting from syphilitic infection are of vital importance and have a great tendency to produce abortion. The liver, spleen, respiratory tract, kidneys and supra-renals have been found to contain the *spirochaeta pallida* and often in large numbers, especially the liver. (Queyrat, Levaditi and Feuille, Reischaur, Bushke and Fiser, Babes and Panea, Salmon, Bryan, Schridde and Flexner.) The presence of the *treponema pallida* in acquired syphilis and also in the hereditary disease with a maximum number in the liver (as the infection comes in the blood by way of the placenta to this organ first), is a strong argument in favor of this organism having an etiological relationship to syphilis.

The foetus may be generally shriveled or dwarfed, or there may be serious visceral lesions, as enlargements of the liver. It is probable that the death of the foetus, in utero, is often due to an infiltration of cells around the blood vessels in the placenta which in this manner immediately affects the nutrition of the foetus.

The bones are nearly always more or less affected at the diaphyso-epiphyseal junction, in early infancy, and the long bones of the limbs, the clavicle, ribs and sternum are the ones commonly attacked. There is a swelling or a ring, at the junction of the shaft with the epiphysis, which may be of slow or rapid growth, and may eventually involve the joint. Properly treated, these lesions usually subside promptly, but if neglected, they undergo degenerative changes and may separate the shaft of the bone from the epiphysis or produce extensive ulcerations.

Later in life a periostitis is more likely to occur, the bones becoming large, tender, bent, nodular and deformed.

**SYMPTOMS.**—The foetus may be expelled permanently and bearing all the marks of skin, bone and visceral syphilis. If born living, soon a troublesome coryza is observed which persists and may be followed by polymorphous skin eruptions. The

lips are shiny in appearance, and may present linear lesions or scars at the junction of the skin with mucous surfaces called rhagades: these are only pathognomonic when the scars are definitely linear and not limited to the corners of the mouth. The skin over the entire body may be dry and wrinkled, giving the child a weazened "old man" look. Other infants may be born apparently free from disease, in whom, within three or four weeks, a general eruption appears which is followed by snuffles, mucous patches, rhagades and perhaps enlargement of the liver and spleen. There may be a diffuse infiltration of the skin which produces copper colored areas and, if at a mucocutaneous junction, results in fissures. There is always anemia. The bridge of the nose is usually broad and flat. About the age of puberty, or before, may be observed the "ground glass" cornea, Hutchinson's teeth, deafness, bone lesions and dactylitis.

THE SKIN ERUPTION usually occurs before the sixth month and consist of macules, papules, vesicles, pustules, bullae, tubercles and furuncles. The macular or erythematous syphilide is the first to appear and the most common eruption. Beginning as pink spots on the lower abdomen, about the third or fourth week it spreads over the entire body and later assumes a copper color. The papular syphilide may begin with macules and appear much like that of acquired syphilis. When irritated or macerated the papules become eroded and form moist papules or condylomata. The mucous patches which are prone to occur at the corners of the mouth and in the buccal cavity may be considered as characteristic of syphilis. They are usually swarming with the *spirochaeta pallida*. Bullae or large blisters may be seen, at birth or soon after, on the palms of the hands and on the soles of the feet. Levaditi has demonstrated the micro-organism of syphilis in the sero-purulent contents of these bullae. The other skin lesions are not unlike those of acquired syphilis.

**AFFECTIONS OF THE MUCOUS MEMBRANES.**—The most constant symptom of hereditary syphilis is coryza which manifests itself by a serous or sero-purulent discharge from the nose; the swelling interferes with the breathing and causes snuffles, crusts formed of the secretions may form and ulceration of the mucous membrane may finally result. Extension to the larynx causes the characteristic hoarse cry. Mucous patches may develop in the nose or in the mouth around the rectum or vulva; at first they are whitish, sodden-looking patches as if the surface had been touched with nitrate of silver; they then become eroded, ulcerate and may coalesce. It should be remembered that the various lesions of hereditary syphilis often do not follow the regular course they do in the acquired form.

**KIDNEYS.**—Cassel considers infantile nephritis a rather frequent manifestation of hereditary syphilis.



Figure 102.—Hutchinson's Teeth. (Morton.)

**THE TEETH.**—The permanent teeth are irregular, notched and pegged in appearance. Hutchinson observed that the upper central incisors are the test teeth, being short, narrow and thin. After a while a crescentic portion breaks from their edges, leaving a broad, shallow vertical notch which is permanent for some years, but between twenty and thirty becomes obliterated by premature wearing down.

In addition to the shape of the central incisors, Gifford has recently called especial attention to the following dental peculiarities seen in hereditary syphilis:

“Peg-shaped lower permanent incisors; sharply tusked permanent canines; blunt, tusked or pegged temporary canines; high vaulted, imperfectly developed hard palate, preventing the incisors from coming together even when they are of normal size; the tuberculated first molar of Darier which, unless seen early in life, is simply a molar with a carious crown; and the molar with the sloped crown.”

DIAGNOSIS.—Considerable trouble may be experienced in determining if a child has heredosyphilis when, as is sometimes the case, the symptoms are few and equivocal. A copper-colored intertrigo, which resists treatment, or a rebellious anal eczema should arouse suspicion. (Koplik.) The typical hereditary symptoms are snuffles, a dry, pale wrinkled skin upon which an eruption appears within three to four weeks after birth, linear scars around the corners of the mouth, malnutrition, square shaped head, lumps at the junction of the shaft of the bone and the epiphysis, nodosities on the skull, and finally interstitial keratitis, Hutchinson's teeth, deafness and depressed or flattened nose.

THE PROGNOSIS depends not only upon proper medication, but also upon proper food and environment; breast fed infants are more likely than bottle fed to survive. Antisyphilitic treatment often works wonders, but must be kept up until the Wassermann remains negative.

SUMMARY.—Syphilis may be transmitted from either parent. Either the child or the mother may appear to be free from all clinical evidences of the disease, and yet the Wassermann reaction be positive. These patients should be considered as infected with syphilis in a modified or latent form rather than as immune. The more active the disease is in the parent the more likely is it to be transmitted to the offspring.

The evidences of syphilis may be present at birth or within a few months after birth or they may be retarded occasionally until the eighth or twelfth year.

The early changes in the foetus are so decided that there is a great tendency for abortions to occur. If born dead the foetus will usually show well marked evidences of syphilis. If born living, coryza or snuffles soon develops and may be followed by polymorphous skin lesions. The skin may be wrinkled and dry. Others may be born apparently free from the disease, but will develop typical lesions of the skin and mucous membranes about the third to fifth week. The typical symptoms of hereditary syphilis are: snuffles, a dry, pale wrinkled skin, upon which an eruption develops within three or four weeks after birth, linear scars around the corners of the mouth. Malnutrition, a pear shaped head, humps at the junction of the bone and epiphysis, nodosities on the skull, and finally interstitial keratitis, Hutchinson's teeth, deafness and a depressed or flattened nose. The prognosis depends both upon the proper food and care, as well as persistent antiluetic treatment.



## CHAPTER XXXI

CLINICAL INTERPRETATION AND APPLICATION  
OF THE WASSERMANN REACTION

THE WASSERMANN REACTION IN CHANCRE, PARASYPHILIS AND  
TABES, CEREBRO-SPINAL FLUID, TECHNIC OF SECURING FLUID,  
SPIROCHAETA PALLIDA, LATENT STAGE, REACTION  
IN WOMEN WHO HAVE BORNE SYPH-  
ILITIC CHILDREN, HERED-  
ITARY SYPHILIS, VAL-  
UE OF REACTION.  
SUMMARY.

While the complement fixation test is the most valuable laboratory aid that we have in the diagnoses of syphilis, except the demonstration of the spirochaeta pallida, many misconceptions exist as to the significance of the test. Much harm may result from unwarranted deductions whether positive or negative. The interpretation should always be considered in connection with and subservient to the clinical symptoms.

A distinctly positive Wassermann reaction means that the patient has syphilis provided the following affections are eliminated: framboesia, relapsing fever, trypanosomiasis and leprosy. As these affections are rare in this country, they need cause little confusion in the interpretation of the test. Scarlet fever has been said to give a positive reaction, but the more competent and experienced observers now deny that this is true. At most it is only a pseudo-reaction and can be eliminated clinically. Malaria and sclero-derma react in a similar manner.

A negative reaction is less reliable and must always be received with certain reservations. It is quite conceivable that latent or isolated foci of infection may exist in such a manner

as to afford so limited an amount of the reaction-forming substances in the blood stream that the test is negative. In such instances the negative test may become positive if made within one to five days after an injection of salvarsan or neosalvarsan. This is called the "provocative" injection test and in our work we have found it of more delicacy than is the reaction if made without such an injection. To Gennerich, of Keil, and Milian, of Paris, belong the credit of calling attention to this phenomenon. While working independently they reached the same conclusion simultaneously. Its practical application affords one of the greatest advances in the management of syphilis since the discovery of salvarsan, unless it be the cultivation of the spirochaeta palliada by Noguchi. This provocative injection stirs up, as it were, the spirochetes and brings their products into the circulation and thus renders it more delicate in the very cases in which we need it most, namely, the obscure and latent conditions. McDonagh, of London, has made an extensive study of this test and confirmed the observation and is convinced of its importance. If the patient is nearly well the strength of the reaction diminishes and perhaps in ten days it may become negative. Treatment should be continued as long as it remains positive when the provocative test is used. Such tests should be made in six months and again one and two years after the patient appears to have been cured.

If the patient develops a positive reaction after the cessation of treatment, it clearly indicates that treatment should again be resumed and either pushed more energetically or another form of treatment should be substituted or used to supplement the remedy being used. This applies with special emphasis if the Wassermann reaction is positive during the course of treatment, as it affords evidence that the drug being used is at least relatively inefficient.

**THE WASSERMANN IN CHANCERE.**—Early in chancre, that is, before two to five weeks have elapsed, the test is usually negative. It becomes slightly positive when the spirochetes become disseminated and then gradually decidedly positive as the secondary stage develops, often a positive reaction may be obtained before the secondary manifestations appear.

Craig has made a valuable report of the work done in the U. S. Army with the Wassermann test and observed that a double plus reaction occurred in 13.8 per cent. during the first week after the initial lesion; 22.1 per cent. during the second week; 41.4 per cent. during the third week; 53 per cent. during the fourth week, and 61.5 per cent. during the fifth week. He states that he has never seen a positive test become negative except by treatment. This is a very significant fact when the specificity of the reaction is considered. It is of great advantage to the patient if active medication can be started before this widespread outbreak develops. By its early eradication the infection may be prevented from being carried to others.

**SECONDARY STAGE.**—The active symptoms present during this stage afford, as a rule, ample evidence of the luetic nature of the disease, and, consequently, render the Wassermann test of little practical use, unless doubt exists. It is positive in about 95 per cent. of the cases during the secondary period. A double plus or triple plus reaction is observed much more frequently in this stage of syphilis than in the primary, tertiary or latent stages. A negative reaction is of more value in the secondary period than in any other, but it should be remembered that about 5% of syphilitics are negative during this time.

**TERTIARY STAGE.**—The reaction in this stage is positive in from 70 to 80 per cent. That tertiary lesions are caused by living spirochetes is proved by the promptness with which they disappear when remedies are administered that kill the spir-

ochetes. Furthermore, these organisms have been occasionally found in the lesions. Neisser succeeded in infecting monkeys with syphilis by the inoculation of material from closed gummata. Reuter also demonstrated the spirochaeta pallida in aortitis. The apparent non-infectious character of tertiary lesions appears to be due to the small number of organisms present. The severity of the lesions with so few organisms has been explained by the allergic condition or hypersensitiveness developed by the tissues. These facts show us the cause of the apparent discrepancies between the scarcity of spirochetes and the frequency of positive Wassermann reaction in tertiary and parasyphilitic affections.

Craig found that practically 15 per cent. of the cases of tertiary syphilis which presented symptoms at the time of making the test gave negative reactions, a fact of great importance in interpreting the Wassermann test in tertiary syphilis.

**PARASYPHILIS AND TABES.**—The Wassermann in these affections vary according to the stage, activity and extent of the disease. In tabes it is present in about 60 per cent., while in paresis it is positive in nearly every instance. It is often very difficult to render negative with treatment no matter what remedy is administered.

**CEREBRO-SPINAL FLUID.**—This fluid sometimes affords a positive Wassermann when the blood serum is negative. It is of particular importance in the parasyphilitic affections when the blood serum fails to react positively.

**TECHNIC OF SECURING THE SPINAL FLUID.**—The patient is placed on his side with the knees drawn up so as to flatten the lumbar region. The skin should be painted with iodine, and the hands of the operator of course should be well cleansed and the needle sterilized. The needle should be three inches in

length and of 17 or 18 gauge. A spinous process on a level with the crest of the ilium is chosen and the needle inserted slightly below the process in the mid-line, the point being directed slightly upward. A small amount of cocaine previously injected into and under the skin lessens the pain. If the patient is suffering with cerebro-spinal meningitis and will not remain still a general anesthetic may be necessary. If the needle becomes blocked, a stilet should be inserted to clear it.

From 10 to 20 c.c. of fluid may be withdrawn into the sterile test tube and centrifuged. The sediment should be stained to determine the presence and character of the cell content. (If the lymphocytes are more than 5 to 7 per c.m. it probably indicates the presence of cerebral or spinal syphilis or tabes.) The remainder of the fluid is used for the Wassermann, a much larger quantity being necessary than in making the test with blood serum.

The *spirochaeta pallida* has been demonstrated occasionally in the spinal fluid in the secondary stage, without any manifest nervous symptoms. This point should be remembered when considering the so-called nerve relapses. Nichols and Hough have reported instances in which a rabbit was inoculated with syphilis from the cerebro-spinal fluid of a patient who had a neuro-recurrence following an injection of salvarsan. This was the first instance in which the presence of the *spirochaeta pallida* had been demonstrated in a nerve relapse and appears to prove that these manifestations are of syphilitic origin. (See Neuro-Recurrences.)

**LATENT STAGE.**—Ehrlich has referred to a non-sterilizing immunity where the patient remains free from evident lesions, but still harbors the spirochetes which only develop when the host's resistance has been lowered by intercurrent disease, trauma or other conditions. During this period the patient is

immune to further infection with the spirochetes. If our results in the future are to make a creditable showing it must come from a careful study of this latent period of syphilis. While in the past this quiescent stage received little attention and was thought unimportant, we have but to consider the widespread ravages of the disease in the form of paresis, locomotor ataxia and all of the so-called parasyphilitic affections, to be impressed with the insecurity of our former method of management. The dawn of a new era is apparent, an era in which we will place little confidence in negative clinical symptoms, an era in which we will seek cures that conform to continued negative serologic tests. Unfortunately, a much greater number give negative results in latent conditions, and so we need the provocative Wassermann test, leutin or syphilin tests in addition to ample and consecutive treatment. The spinal fluid will not infrequently give a positive reaction when the blood is negative, therefore it should be remembered when making the diagnosis in doubtful parasyphilitic conditions. The Wassermann test has shown that disease of the aortic valves and aneurysms are frequent sequels of syphilis. The Wassermann is found more frequently in general paralysis than in any other stage of syphilis, except the active secondary period.

**THE WASSERMANN REACTION IN WOMEN WHO HAVE BORNE SYPHILITIC CHILDREN.**—Under this subject we have had light thrown upon a formerly obscure part of syphilis. We did not understand why it was that these patients were apparently immune to syphilis. Knopfmacher and Lehndorff found that the serum of 90 per cent. of mothers of syphilitic children was positive if tested within a few months after the birth of such babies.

The percentage is smaller several years later. Such individuals are clearly infected with syphilis in a modified and

otherwise latent form. Why the infection when so contracted should pursue a course so different from the usual disease no one has yet explained. McDonagh as well as Hutchinson has reported more or less typical tertiary lesions in these patients. Certain exceptions to Colles' law would indicate that occasionally purely paternal syphilis may occur. This is at present unexplainable also, but affords an interesting field for study and speculation.

HEREDITARY SYPHILIS.—After an extensive study of the Wassermann in hereditary syphilis, Leroux and Labbe make the following statement:

"Serum diagnosis is useful in the study of heredo-syphilis, but to be of value should be completed by systematic research of family syphilis, by the same method; otherwise many cases of latent infantile hereditary syphilis or parasyphilis will escape notice, as well as many cases of latent or unknown family syphilis. The authors obtained a positive reaction in nearly all cases of early heredo-syphilis with active symptoms; in 85 per cent. of cases of late heredo-syphilis, but in only 11 per cent. of latent cases. Healthy children issued from syphilitic families all gave a negative result. In the heredo-para-syphilis (dystrophics and degenerates) the reaction was always negative. In the mothers of syphilitic children the reaction was positive in 71 per cent. whether they had symptoms of syphilis or not. The fathers of the syphilitic children gave a positive reaction in 42 per cent. These authors assert: (1) That maternal syphilis is more often latent without manifestations, and more often virulent because unrecognized and untreated; (2) that the maternal syphilis is more often conceptional than acquired directly from the father; (3) that the frequency of conceptional syphilis explains Colles' law— a syphilitic child procreated by a syphilitic father never infects the mother, because she is already infected; (4) that the number of cases of purely paternal transmission is

small, because in the great majority of cases the mother is also infected."

THE VALUE OF THE WASSERMANN REACTION.—The gradual appearance of the Wassermann reaction as the chancre develops and finally its almost constant occurrence during the later active syphilitic manifestations, fluctuating according to the intensity of treatment and the activity of the disease, shows clearly, we think, the specificity of the test, with certain exceptions previously noted. This seems further shown by the fact that the patients who have received sufficient treatment to render this reaction permanently negative, also fail to develop recurrences of syphilis; if recurrences do arise after a period of quiescence they are nearly always preceded by a positive reaction. As regards the interpretation of the Wassermann test, Craig says: "If the diseases in which the Wassermann complement fixation test has occasionally been found positive can be excluded, a double-plus reaction is sufficient to enable one to diagnose the presence of syphilis. Under such conditions, I consider the test absolutely specific, whether symptoms of the disease are present or not, and whether there is or is not a history of infection. Under the same conditions, and with a history of infection or the presence of clinical symptoms, a plus reaction should also be interpreted as diagnostic of syphilis. A diagnosis of syphilis should never be made on the presence of a plus-minus reaction alone. Many normal individuals will give a plus-minus reaction at times and therefore such a reaction cannot be considered as having any more value than a negative reaction, in the absence of a history or symptoms. A single negative reaction is of no value in excluding syphilis. Only when such a reaction is obtained on repeated examinations for at least a year after cessation of treatment can it be considered as evidence of the absence of the disease, and the luetin test



should be made to corroborate the Wassermann result. In the interpretation of a negative result the history of the patient, the presence of symptoms and the amount of previous specific treatment must all be carefully considered."

THE HERMANN AND PERUTZ REACTION FOR THE DIAGNOSIS OF SYPHILIS.—A number of reports have shown satisfactory results from this reaction which is much simpler than the Wassermann and while perhaps not so reliable is of some value. The test consists of inactivating the serum to be tested at 55° C. for half an hour, and to 4.4 c. cm. of this added .2 c. cm. of solutions No. I and No. II. Solution No. I is two grams of glycocholate of sodium and 0.4 gram of cholesterin, dissolved in 100 grms. of 95 per cent. alcohol. This has to be diluted with 20 parts of water before use. Solution No. II is a 2 per cent. watery solution of the glycocholate of sodium. The mixtures are then well shaken and left standing at ordinary room temperature. A characteristic separation of a flocculent precipitate indicates a positive reaction. According to the amount of this, the reaction is regarded as moderate, strong, or very strong.

Jensen and Feilberg make the following report concerning the test:

"Of the 153 samples, 63 were taken from persons who, as far as could be ascertained, had never had syphilis. In all the reaction was negative, and in all in which a Wassermann test was applied, this was also negative. Of the 90 syphilitic samples, 30 were in a latent stage and gave a negative Wassermann reaction; they also yielded a negative Hermann-Perutz reaction. Of the remaining 60 samples, 55 gave a positive Wassermann reaction and in the case of five this test was not applied; 43 of them gave a positive Hermann-Perutz test. Of the seventeen which yielded a negative reaction, some gave a very weak Wassermann reaction, while in two the samples were taken from cases of late hereditary syphilis, which often gives a doubtful

Wassermann reaction. Three patients had undergone inunction treatment. Since the Hermann-Perutz reaction, when positive always corresponded to a positive Wassermann test, the authors considered that for clinical purposes this test can be carried out first, and if it be positive, the diagnosis of syphilis may be accepted in every case. If negative, it may be advisable to employ the Wassermann test, which is somewhat more delicate."

WEIL'S TEST.—Weil found that syphilis rendered blood corpuscles resistant to the hemolytic action of snake venom. The patient's blood is washed in a 2% solution of sodium citrate. Cobra venom diluted 1-10000 to 1-40000 is added to a tube containing washed red cells, and is then incubated. The absence of hemolysis in dilutions up to 1-10000 is regarded as positive. The slightest degree of hemolysis in the tube diluted 1-30000 is regarded negative, and a strong negative is present if there be the slightest trace of hemolysis in the dilution 1-40000. He claims for it greater activity in latent syphilis than in any hemolytic test.

SUMMARY.—Although the complement fixation test (the Wassermann reaction) is a valuable laboratory aid in the management of lues, many misconceptions exist as to its interpretation. This applies particularly to the negative reactions, as non-specific affections which give a positive reaction may, as a rule, be eliminated readily by the clinical manifestations. This reaction gradually becomes positive as the spirochetes develop, and gradually disappears as their extermination proceeds. The reaction usually again becomes positive in case a recurrence of syphilis occurs. It is, therefore, necessary to secure a persistently negative reaction in patients who are not being treated. A single negative Wassermann does not mean that spirochetes are absent. The interpretation should always be considered in connection with the clinical symptoms and history. In

cerebro-spinal syphilis the spinal fluid affords a more reliable test than does the blood. The cell content of the spinal fluid is also of great value in differential diagnoses. A moderate increase in the lymphocytes in the fluid is thought to indicate cerebro-spinal lues when tuberculosis and pellagra are eliminated.

The Wassermann reaction should be utilized to assist in the management of syphilis, but not to supplant careful clinical examination and the study of the clinical histories.

The Hermann-Perutz reaction is said to be of value when positive, but when negative, is of less value than the Wassermann. Weil's test is dependent upon the fact that syphilis renders the red blood corpuscles resistant to the hemolytic action of cobra venom.

## CHAPTER XXXII

## TREATMENT OF SYPHILIS

CHANCRE, MERCURIAL AND INTERNAL TREATMENT, INUNCTIONS,  
INTRAMUSCULAR INJECTIONS, MERCURIAL FUMIGATIONS,  
COMPLICATIONS, SALVARSAN FOR SALIVATION, CONDY-  
LOMATA, TREATMENT OF HEREDITARY SYPHILIS,  
INTERSTITIAL KERATITIS, SUMMARY

CHANCRE.—The chancre requires very little treatment and, as a rule, will heal satisfactorily if kept clean. A powder containing equal parts of calomel, stearate of zinc and bismuth subnitrate should be applied to the chancre four to six times daily after washing. If it is slow in healing iodoform one part and balsam peru two parts may be applied every other day, instead of the powder. Occasional applications of 8% scarlet red ointment may also stimulate the healing process. Active antisymphilitic treatment should be begun as soon as the diagnosis is made and the least possible time should be lost in making the diagnosis. This does not imply that undue haste should permit the diagnosis of syphilis to be made until positive evidence is obtained.

If certain that chancroidal infection does not complicate the chancre and if the glands in the groin are not extensively involved, the chancre may be excised and salvarsan or neosalvarsan injected. It is in such instances that we secure the most uniform results in quickly checking the course of syphilis. Therefore we make every effort to demonstrate the *spirochaeta pallida* or secure a positive blood test at the earliest possible moment. Treatment should never be started until a positive diagnosis is thus made or by the appearance of the secondary

symptoms. The danger of spreading the contagion both from the primary and later lesions should be fully explained to each patient.

If much induration exists it is of great importance to have the patient soak the penis in hot water so as to bring the greatest amount of blood containing salvarsan or neosalvarsan to the point at which it is most needed. Hot fomentations should be placed over enlarged glands in the groin or over other lesions several hours daily.

**MERCURIAL TREATMENT.**—If there are reasons why salvarsan or neosalvarsan should not be given and why mercury seems indicated, the following should be remembered: The patient should be sent to a dentist for the removal of tartar from the teeth and to have cavities filled, or the carious teeth drawn before administering mercury. The plan of treatment and the forecast should be explained to the patient. Stress should be placed upon the importance of entire co-operation and upon the danger and calamity that are likely, otherwise, to occur. Alcohol, tobacco and overwork should be interdicted, and especially should sexual intercourse be forbidden.

Patients who are in the habit of taking alcoholic drinks may be allowed a small quantity of wine with dinner. Extraordinary care should be taken to keep the mouth clean and healthy.

**INTERNAL TREATMENT** is the simplest and commonest mode of administering mercury. Mercury was originally introduced into Europe by the Arabians, and for hundreds of years it was the most valuable of the remedies used in the treatment of syphilis. The protoiodide may be given in 1-6 gr. tablets, one of which should be taken after each meal, the dose being increased one tablet a day until about six or eight are taken daily or until the teeth show a slight tenderness when sharply closed.

Soreness and bleeding of the gums demands immediate cessation of the treatment.

If salivation is not caused and the digestion is not disturbed, the dose of protoiodide may be raised gradually to two or two and a half grains daily. Diarrhoea and cramps in the bowels are sometimes caused before the syphilitic symptoms have been brought under control, and these indicate the administration by inunction or by injection or supplementary treatment with salvarsan. Opium should rarely be given to relieve these symptoms as it increases the danger of salivation. Tannate of mercury may be begun in  $\frac{1}{2}$  gr. doses and gradually increased to  $2\frac{1}{2}$  grs. a day, unless there are untoward symptoms before this amount is reached. Biniiodide of mercury may be given in 1-15 grain doses three times daily and gradually increased. This preparation causes a considerable gastro-intestinal disturbance. The entire condition of the patient should be carefully watched and should be used as an indication of effect of this remedy. Anemia should be combated with iron and tonics, and the patient urged to take moderate exercise in the open air. Robinson recommends pilocarpin to aid the elimination of mercury through the skin and glands, and reports good results from its administration where the system is saturated with mercury in a more or less dormant state, and therefore useless state. He claims that if pilocarpin be given for a week or two and then discontinued, smaller doses of mercury will give equally good results. Salivation and mercurial stomatitis are also benefited by small doses of pilocarpin, because it aids in removing the mercury contained in the glands. The dose of pilocarpin should be from 1-32 to 1-8 of a grain, in a pill, two or three times daily.

Mercury should be used for the first six months, being given almost continuously during this period, with perhaps a few short intervals to give the stomach a rest or to prevent sali-

vation. An intermission in the treatment for three or four weeks may be allowed at this time if all the evidences of syphilis have disappeared. Tonics, iron, fresh air and a change are to be insisted upon during this time. The treatment may be resumed with inunctions, injections or with the internal medication and, except during other intervals, should be continued until at least two to three years have elapsed.

**INUNCTIONS.**—The method of rubbing mercurial ointment into the skin is a valuable but troublesome form of treatment. It has the advantage of disturbing comparatively little the gastro-intestinal canal, thus leaving the stomach and intestines in better condition to assimilate a maximum of food, tonics and iodides. Fifty per cent. mercurial ointment should be used and in doses ranging from 2 to 4 (30 to 60 grs.) daily. The dose may be weighed out by the druggist and wrapped in separate papers. The inunctions should be made in a systematic manner over the entire body, which may be subdivided for each treatment, as follows: the chest; the abdomen; the thigh and groin; and the legs. By this plan sufficient time is allowed to elapse between rubbing each area to prevent irritation of the skin. Before each inunction the parts should be washed with soap and water and then with 1-100 carbolic acid solution. The ointment should be thoroughly rubbed in until little is left upon the skin. Sufficient rubbing requires from twenty to thirty minutes. The skin should not be washed until eight to twelve hours after the treatment. Where possible, it is always advisable to have the inunctions administered by a professional "rubber." The patient must, in all cases, be carefully watched for salivation, digestive disturbances and dermatitis, as well as for evidences of insufficient treatment, and the amount of ointment regulated accordingly.

After twenty-five to fifty inunctions have been administered, the patient should be allowed to rest for two to four

weeks; then there should follow another course of inunctions. No matter what method of administration is employed, mercury must always be continued with the other remedies until all clinical and serologic evidences of syphilis disappear and remain away. Definite rules cannot be made as different patients require different amounts of treatment. Each must be treated individually.

**INTRAMUSCULAR INJECTIONS.**—This plan possesses many advantages over either the internal treatment or inunctions. The dosage can be accurately regulated, the gastro-intestinal tract spared, the tedious rubbing obviated, and at the same time most excellent results can be obtained. For injections, the insoluble salicylate is the most satisfactory of all the different forms of mercury. Bichloride of mercury may be taken as a type of the soluble preparations of mercury, and although very effective, it is painful and must be given every day or every other day.

Bichloride of mercury may be dissolved in oil and administered intramuscularly in  $\frac{1}{2}$  to 1 grain doses every week. This eliminates the severe pain and permits a larger dose to be given, which is slowly absorbed. We strongly recommend the following prescription:

R

Quinine and urea hydrochloride.....	0.66.	grs. x.
Dissolved in smallest amount of		
water and then rubbed with		
Dehydrated lanolin.....	10.	ʒiiss
Creosote	} previously mixed a.a.....	4. ʒi
Camphor		
Salicylate of mercury.....	3.	grs. 48
Olive oil.....	q.s.a.d. 30.	ʒi.

M.

One drop of this represents 1-10 grain of the salicylate of mercury and the dose varies from 7 to 10 drops once a week, or half this amount twice weekly. The preparation remains



sterile, and causes less pain than the usual combination of salicylate of mercury. It is well to begin with seven drops and gradually to increase the amount, as the condition and symptoms indicate. Almost any kind of a glass syringe may be used, but it is preferable to have one sufficiently accurate to estimate easily small amounts. The hypodermics with the ordinary leather plunger seem preferable to the close fitting glass or metallic ones, because not infrequently difficulty may be encountered on account of the small particles clogging the piston. The needle should be of a large caliber, from  $\frac{3}{4}$  of an inch to  $1\frac{1}{4}$  inches in length.

The injections should be made in the gluteal muscles, and on alternate sides. The best site for inserting the needle is the upper outer portion of the buttock, in a thick mass of muscle. Care should be taken not to deposit the medicine just under the skin, in a mass of fat, in the fibrous tissue around the bones nor near the large nerves or blood vessels.

Gothheil, to whom we are indebted for our present technic of administering mercury in this form, says that pain and disability that some observers report are undoubtedly due to the selection of an improper site for making the injection. The skin is washed with a 1-1000 solution of bichloride of mercury and wiped with a piece of cotton saturated with alcohol. The suspension of salicylate of mercury is well shaken and drawn into the syringe. Air bubbles are expelled from the syringe, and the needle quickly thrust into the thick part of the muscle. The piston is now drawn so as to bring blood into the barrel of the syringe if the needle has entered a blood vessel. If blood is seen the needle is withdrawn and re-inserted. This precaution should never be omitted although the blood vessels will not be entered oftener than one time in about five hundred. If no blood is drawn into the syringe the suspension is slowly deposited in the muscle. The pain is very slight if the needle is

quickly plunged up to the hilt and is just as quickly withdrawn. The minute opening in the skin is sealed with collodion. There is nearly always more or less dull aching on the side upon which the injection is made, which may continue for one or two days and occasionally longer, but rarely are patients encountered who regard the pain as of sufficient moment to call for a discontinuance of the treatment. It is variable in the same patient and without any apparent reason. Nodules may form at the site of the injection and disappear within a few days or they may persist for as long as a week or ten days. Abscesses are very rare; so far the writers have not had one to follow an intramuscular injection.

After about three months the injections should be stopped for three or four weeks and the patient given tonics and iron. The treatment is again continued, with these intervals, and kept up for two years or longer. During the latter part of the time iodide of potash should be given in increasing doses. The iodide may be given with advantage earlier if precocious tertiary lesions are present.

**MERCURIAL FUMIGATIONS** are comparatively less reliable and more likely to induce salivation.

**IODIDES.**—Beginning with the eighteenth month, or earlier if indicated, iodide of potash should be given and kept up for six months or longer. A saturated solution contains about one grain to a minim and affords a satisfactory way in which to prescribe it. About ten minims may be given as an initial dose, which is increased one minim per day until the physiologic limit is reached. The amount that can be taken varies greatly with different individuals, and is somewhere between 50 and 100 grains a day. The saturated solution should be diluted with a full glass of water and taken from one to two hours after meals and followed in a half hour by another glass of water. Potassium

iodide may also be given with advantage in boiled milk; 3ss to 3i doses of aromatic spirits of ammonia taken with it, tends to prevent depression and increases the action of the iodide. The physiologic effect of the iodide is manifested by coryza, a feeling of depression, hard tender papules on the back or face, and by the formation, occasionally, of an intractable ulcer. The administration of arsenic with potassium iodide may prevent or lessen its toxic effect. If, in spite of these precautions, disturbance continues, syrup of hydriodic acid, compound tincture of iodine or iodalbin may be given instead of the iodide. Generally speaking, the iodides are indicated whenever there are tertiary symptoms or extensively indurated lesions.

In order to liberate the iodine from the iodide and thus enhance of the value of this remedy Curle has used chlorine solution in about 30 c.c. (1 ounce) doses two or three times daily. This is about the amount to be used for 2 grams (30 grains) of potassium iodide daily. The dosage of both should be regulated according to the patient's requirements. The chlorine solution which Curle employs is prepared by mixing in a dry 600 c.c. (24 ounce) bottle, 4 grams (60 grains) of dry potassium chlorate in a fine powder, 120 minims of strong hydrochloric acid, and after stoppering and shaking until effervescence has ceased, adding cold water little by little to fill the bottle, shaking after each addition of water. It may be administered in lemonade.

Iodide of potash may be given without causing gastric disturbance when combined with suet and paraffin, as in the following prescription:

Rx.

Iodide of potash.....	64.	3ii
Suet.....,	24.0	3vi
Paraffin.....	5.0.	3iss

Mix and melt in water bath. While melted, encapsulate in ordinary 00 gelatin capsules. Four to six of these capsules

may be administered daily. The mass is not digested in the stomach, but gradually digests as it passes down the intestines.

COMPLICATIONS.—Salivation begins as a soreness of the teeth, if they are quickly brought together; the gums become inflamed, have a black line at their margins and may bleed. The breath has a fetid odor and there is an increase in the flow of saliva. There is a feeling of soreness in the jaw and tartar often rapidly accumulates on the teeth.

When patients are taking internal treatment or inunctions they should be told to stop the mercury immediately upon the appearance of any of the above symptoms and report for further directions. The black line at the margin of the gums should be firmly pressed by the patient two or three times daily before the gums become sore. Iodide of potash should never be given at this time, as it eliminates the mercury and makes the salivation worse. The patient should take a brisk purgative and devote especial attention to keeping the teeth and mouth clean. If the inflammatory symptoms are slight a tablet of potassium chlorate may be dissolved in the mouth several times a day and acetate of lead, 3 or 4 grains to the ounce of water, may be used several times daily as a mouth wash.

SALVARSAN FOR SALIVATION.—Nothing seems to give more prompt relief than the intravenous administration of salvarsan or neosalvarsan. When one studies the smears taken from the gums and sees the enormous number of spirochetes present, and playing a part in the inflammatory process, the reason for the prompt relief becomes apparent. Undoubtedly the spirochetes found around the teeth play an important part in the inflammation of the gums when the resistance is lowered by the local deposit of or the injury by mercury. Thus it appears to be a double process, namely, the presence of local injury produced by mercury and continued by spirochetes.

Mercury should be continued in smaller doses after the cessation of the symptoms of salivation.

CONDYLOMATA should be kept dry, when possible, and covered with equal parts of calomel and zinc oxide. They readily heal after the administration of salvarsan as do mucous patches though previously resistant to mercury.

TREATMENT OF HEREDITARY SYPHILIS should begin, when possible, before the birth of the infant, by active treatment of the mother. Small doses of salvarsan or neosalvarsan repeated and gradually increased and supplemented with mercury are to be strongly recommended.

After the diagnosis of heredo-syphilis in an infant, treatment should be begun at once and continued until the patient is entirely free from lesions, symptoms or serologic evidences of lues. There is a tendency for relapses and tertiary lesions to occur unless the treatment is effective and persistent. Calomel in  $\frac{1}{4}$  to  $\frac{1}{2}$  grain doses, three times daily, varied according to the age and symptoms, is a favorite remedy. Mercury with chalk is another valuable preparation, and may be given in doses from  $\frac{1}{8}$  to  $\frac{1}{3}$  of a grain, three times a day. Inunctions may be given with from 5 to 15 grains of the 50% mercurial ointment or it may be used as plaster applied to the back or upon a band around the abdomen. For infants intramuscular injections of neosalvarsan in small doses every one or two weeks, according to the absorption, should be used to supplement the mercury. Or, if preferred, the suspension of salvarsan in anhydrous lanolin, as prepared by Hynson, Wescott & Co., may be employed intramuscularly in small doses repeated as the neosalvarsan.

These measures should be selected or varied according to conditions. The nasal ulcerations should be treated with the white or red precipitate ointment. Iodide of potash need not

be administered until the tertiary stage has been reached, but should be pushed if retarded syphilitic symptoms appear. Iron tonics are required if anemia is present. Unless the infant is breast fed, special attention should be devoted to supplying proper food.

INTERSTITIAL KERATITIS should receive active combined treatment and instillations of 1% solution of atropin to keep the pupil dilated during the height of the disease. Treatment seems to have little effect at times, however, and the second eye may become inflamed while the treatment is being taken; tonics are often of distinct value. The most hopeless looking cases should never be despaired of. After the irritation has subsided, hot applications should be placed over the eye and the ointment of yellow oxide of mercury gently rubbed into the conjunctiva and over the cornea, to hasten the absorption of the opacities. The acute symptoms respond readily to salvarsan and the pain promptly subsides though the cloudiness slowly disappears and gives discouraging results—the most unsatisfactory observed with salvarsan except in late nervous affections.

All active or latent manifestations of syphilis should be treated until the serologic and luetin tests prove the cure to be complete.

SUMMARY.—It is the opinion of those who have had the greatest experience in the treatment of syphilis that mercury and iodide of potash should be used to supplement the treatment with salvarsan and neosalvarsan, and vice versa. The best way to give mercury is the salicylate intramuscularly in one grain doses every week or the bichloride of mercury dissolved in olive oil. To secure this latter preparation it is dissolved in the smallest quantity of water and then carefully rubbed with sufficient anhydrous lanolin to take up the aqueous solution

of bichloride. It is then mixed with sufficient olive oil to make a 5% solution. Camphor and creosote are added, 10% of each, being previously mixed. From 10 to 20 minims of this 5% solution of bichloride may be administered intramuscularly once weekly. Next in value come mercurial inunctions, two to four grams being well rubbed into the skin once daily. No matter with the method of administration, the mercury should be given in courses with intervals for rest, tonics, etc. Since the advent of salvarsan, mercury does not have to be given in such large quantities as formerly, as the two combined work like magic. Iodide of potash is indicated whenever there are tertiary lesions. It is not a spirochetocide, but assists greatly in healing gummatous lesions.

Where possible the treatment of hereditary syphilis should be started before the birth of the child. Mercurial inunctions and small intramuscular injections of neosalvarsan comprise the best measures to combat hereditary syphilis. The injections of neosalvarsan should be given every one or two weeks according to the absorption. All treatment should be continued until the luetic manifestations disappear and remain away, and the blood test remains negative.

## CHAPTER XXXIII

## SALVARSAN (606) AND NEOSALVARSAN (914)

ATOXYL, EFFECTS OF SALVARSAN, RESISTANT STRAINS OF SPIROCHETES, PREPARATION OF SALVARSAN AND NEOSALVARSAN, INJECTIONS, TECHNIC, CONTRAINDICATIONS TO SALVARSAN AND NEOSALVARSAN, HEART LESIONS, RENAL LESIONS, THE LIVER, DIABETES, CEREBRO-SPINAL AFFECTIONS, EYE, EAR, THROAT, NOSE, REACTION, ELIMINATION AND SUMMARY

While syphilis has been treated more or less successfully since its widespread outbreak in Europe during the latter part of the 15th century, unfortunately the success was limited to a clearing or healing of the lesions as a rule rather than a complete eradication of the spirochetal infection. In later years greater success followed persistent and appropriate application of mercury and potassium iodide which often acted in a magical and specific manner in the promptness of their results. Mercury is a spirocheticide, but iodide of potash seems to act in some other way and assists in the cure and absorption of lesions, especially gummata, rather than by killing the spirochetes. Later still came the discovery of the Wassermann reaction and the *spirochaeta pallida*, inoculation of apes and rabbits, the cultivation of the *spirochaeta pallida*, the provocative Wassermann reaction, and the luetin tests. Along with these epoch-making discoveries a more scientific treatment and more accurate tests to determine if the patient was cured or at least as perfectly cured as at present can be secured.

Notable improvement in the treatment began with the introduction of the arsenical preparations which have a specific spirochetocidal action. The most important of these were atoxyl,



arsacetin, arsenophenylglycin, salvarsan and neosalvarsan. To Paul Ehrlich, of Frankfort-on-the-Main, is due great credit for the discoveries already made with these arsenic preparations as well as for the "chemotherapy" and its underlying principles which bid fair to inaugurate a new line of investigation which has already interested many scientific observers and may decidedly enrich our therapeutic measures of the future. We regret that the somewhat abbreviated scope of this book forbids the full description of Ehrlich's preliminary and exhaustive experiments.

ATOXYL.—An organic preparation of arsenic known as atoxyl was introduced by Thomas as a remedy for sleeping sickness, and later for syphilis, was a disappointment on account of optic atrophy and other bi-effects which it produced. This drug, however, afforded a starting point for experimentation, and arsacetin, arsenophenylglycin and many other preparations followed until Ehrlich and Hatta reported an encouraging series of experiments with dioxydiamedoarsenobenzol, the 606th combination tested and later called salvarsan. In his chemotherapeutic experiments with sleeping sickness and fowl spirillosis, Ehrlich found three groups of remedies which possess more or less curative properties:

1. The arsenical compounds; including arsenious acid, atoxyl and more recent derivatives of phenylarsenic acid, namely, arsacetin, arsenophenylglycin, and salvarsan.
2. Certain azo-dyes of the benzzidin group, for example, trypan-red, trypan-blue, and trypan-violet.
3. Certain basic triphenylmethane dyes, such as parafuchsin, methyl violet, and pyronin.

It was while Hatta was conducting a large series of experiments under Ehrlich's direction that he discovered the spirocheticidal action of 606. Rabbits and fowls were quickly cured of spirochetal infections by injections of this remedy. Relaps-

ing fever was also cured by salvarsan in a much more satisfactory manner than with any previous treatment, curative doses being well within the maximum tolerated dose. It was found that rabbits could be infected with the spirochaeta pallida in the cornea and the scrotum. These infections and lesions quickly responded to injections of salvarsan. The same healing effect followed in similar infections in the anthropoid ape and man.

Clinical experience has shown salvarsan to have the following advantages:

First, it quickly eliminates the danger of spreading the disease to others, as nearly all observers report the prompt healing of syphilitic lesions.

Second, it is much less disagreeable to the patient than is treatment with mercury and iodide of potash.

Third, properly administered it seems less harmful than mercury and iodides.

Fourth, it cures very quickly affections that were uncured after prolonged courses of treatment with other remedies.

Fifth, it often works like a miracle in arresting the progress of malignant syphilis.

Sixth, patients gain in weight and strength to such an extent that those who used it properly are compelled to admit the superiority of 606.

Seventh, the fact that recurrences are very infrequent in the patients who received an adequate course of treatment.

Eighth, being more pleasant to take, the patients are willing to repeat the injections and thus obtain a more thorough cure than many who depend alone on mercury and potassium iodide.

Ninth, if it is deemed necessary, the good produced by salvarsan or neosalvarsan may be supplemented by mercurial treatment, which in such instances does not require such large

quantities of mercury as formerly, when this remedy alone was depended upon to effect the chief part of the cure; therefore, properly used, these remedies should remove the harmful effects of mercury.

Tenth, the unusual interest now taken in the thorough treatment of syphilis ought to perceptibly lessen the number of patients who suffer from parasymphilitic and late nervous affections, which clearly come from uncured syphilis.

Eleventh, since beginning nervous affections are favorably influenced by 606, it does not seem unreasonable to hope that such affections may be prevented by its repeated injections until the Wassermann and other tests remain negative.

NEOSALVARSAN is the name given to the 914th preparation studied by Professor Ehrlich in his epoch-making work. It is said to be the formaldehydesulphoxyl of salvarsan and has certain advantages which 606 has not:

1. It has only to be mixed with water and then is ready for the injections, being neutral solution.

2. Very slight disturbance of the patient is produced by its injection intravenously; nausea, vomiting, diarrhoea, chill and fever being unusual complications, except a slight rise of the temperature when the syphilitic manifestations are acute. The subsequent injections cause practically no reactions and the treatments are not objected to by the patients.

3. The mildness of the symptoms produced enables one to administer full doses with more impunity and at shorter intervals than is the case with salvarsan.

After having administered 1,800 injections, about one-half of them being salvarsan and the other half neosalvarsan, we have reached the conclusion that, dose for dose, salvarsan is more potent than is neosalvarsan. We would say that each has a place as a therapeutic remedy.

When in doubt as to the ability of a patient to withstand 606, we begin with small doses of neosalvarsan. The amount is gradually increased and the dose repeated about once weekly until the improvement permits medium size doses of salvarsan. Mercury and iodide of potash should be given simultaneously or subsequently according to the exigencies of the syphilitic manifestations and the physical condition of the patient. Excellent results may be obtained in the treatment of syphilis with neosalvarsan by giving from 0.3 to 0.6 or 0.7 of a gram for male adults, intravenously, every week until four or more doses have been administered. The dose for women should range from 0.2 to 0.5 of a gram. An interval of one month should be allowed to intervene after four or five intravenous injections have been given and then about three injections administered one or two weeks apart.

Another month is allowed to elapse without neosalvarsan and then an injection should be administered and the Wassermann test made from two to five days later. Subsequent treatment should be regulated by the Wassermann reaction and the clinical symptoms. Treatment should of course always continue until all luetic manifestations have disappeared. If the progress seems slow we should substitute salvarsan and push mercury and iodide of potash. As a rule, as previously stated, salvarsan is more uniformly potent in clearing the symptoms, but is more trouble to prepare than is neosalvarsan.

The reaction following repeated small doses of salvarsan need be no more severe than those following neosalvarsan. The patient need not be confined to the bed nor is the disturbance sufficient to cause any objection to the repeated injections which are so necessary in affecting a lasting cure and in preventing the neuro-recurrences which may follow an inadequate course of treatment with either of these remedies. By giving salvarsan or neosalvarsan in the manner outlined, with the proper technic,

three important factors occur, namely, the disease is cured more completely than by any previous method or remedy; the danger is insignificant both as regards the mortality, neuro-recurrences or injury to the various viscera or nervous system; and the treatment is pleasant for the patient to take.

We make this statement advisedly after having administered more than 1,800 intravenous injections and after a careful review of the literature upon this subject. We believe that most of the harmful effects reported as a result of salvarsan could have been avoided by small or medium size doses repeated from time to time and supplemented with mercury.

EFFECTS OF SALVARSAN UPON SYPHILITIC LESIONS: CHANCRE.—The results have been more uniformly good in the treatment of an early chancre than in any syphilitic manifestation. The earlier the injection is administered the greater is the chance of an immediate cure. By repeating properly the injections such patients will not again show any signs of syphilis. The spirochetes are usually destroyed within from 24 to 48 hours and rapid healing follows unless secondary infection exists. Healing is favored by cleanliness, a powder of calomel, bismuth subnitrate, and stearate of zinc. Hyperemia should be produced by suction or by immersing the penis in water or by covering it with hot fomentations to bring a full amount of blood, carrying the salvarsan to the point at which it is most needed.

Early treatment before the secondary symptoms appear is of great importance, persistent and careful search should be made with dark field illumination until spirochetes are found. Unfortunately, there are times when it seems exceedingly difficult or practically impossible to discover these organisms, especially in healing chancres. About the fourth week, if the inguinal glands are enlarged, the Wassermann test will often be found positive, and thus a correct diagnosis can be made before

the secondary symptoms appear. The enlargement of the inguinal glands does not mean that the disease has been generalized.

We have not felt that the number of injections should be reduced to too small a number on account of the early start in the treatment. We, therefore, give not less than five injections of salvarsan or seven of neosalvarsan supplemented with mercury in spite of negative blood tests.

SECONDARY LESIONS usually respond with remarkable rapidity except the papular syphilide, which may be somewhat resistant to all remedies and therefore requires intensive treatment. Recurrences seem much more likely to follow syphilis when treatment is begun in the early secondary period than at any other time; this is particularly true of neuro-recurrences. Therefore we advise more than the usual course of treatment with salvarsan or neosalvarsan, supplemented with mercury and iodide of potash in all patients who are first treated during the acute secondary stage. We think a single dose of salvarsan or neosalvarsan at this time is peculiarly likely to be followed by a neuro-recurrence.

TERTIARY AFFECTIONS respond quite promptly to treatment. Difficulty may, however, be experienced at times in securing a permanently negative Wassermann reaction.

PARESIS responds favorably to treatment only if it is administered early. Long standing affections offer much less favorable prospects.

LOCOMOTOR ATAXIA.—The favorable action of salvarsan and neosalvarsan in early tabes, as well as in many instances of the fairly well developed disease, seems definitely established. Early treatment though is very important as the disease responds much less satisfactorily when of long standing and gross pathologic changes have occurred.

We may expect a cessation of the shooting pains and the various crises; locomotion becomes nearly normal in early cases and the tabetic process seems definitely checked. Patients gain in weight and the general health improves. The functions of the bladder and bowels become more normal. Retrogression of the symptoms of the disease when far advanced will probably not result. Certainly no other remedy has given us such good results as salvarsan and neosalvarsan. Many of our patients have improved far beyond our expectations.

The treatment should be begun at the earliest possible moment with small or medium doses and repeated every one or two weeks until eight or ten doses have been given, the intervals between treatments should be gradually increased. At times, mercury and iodide of potash may be given also.

Fresh air, tonics, hydrotherapy, massage, good food, and rest or regulated exercise should be employed as the varying indications demand. It is at times difficult, or practically impossible, to render the Wassermann negative. In such instances the treatment should be cautiously continued over a considerable time.

INHERITED SYPHILIS is usually satisfactorily treated except chronic interstitial keratitis; the painful symptoms may respond fairly well, but the cloudiness is very slow in disappearing and requires persistent treatment.

PREGNANT SYPHILITIC WOMEN may be treated with impunity with salvarsan and neosalvarsan, but the doses should be small and frequently repeated so as to effect the cure with a minimum danger of miscarriage.

RESISTANT STRAINS OF SPIROCHETES.—It was feared in the beginning that the spirochetes would develop resistant strains to salvarsan similar to the trypanosomes in sleeping sick-

ness when non-curative doses of aniline dyes and arsenic preparations were administered. In actual work with 606 in man it was observed that repeated injections were necessary to effect a lasting cure as certain organisms were protected in various ways from the remedy circulating in the blood. The danger is that an insufficient number of injections will be given rather than that the organisms will become resistant. Anaphylaxis following repeated injections of salvarsan seems quite unlikely to occur.

#### CONTRAINDICATIONS TO SALVARSAN AND NEOSALVARSAN.

Any serious visceral disease no matter what its cause should be regarded as a red flag, warning of possible danger. Contraindications should be considered relative and absolute. Some of the conditions merely mean that a full size dose estimated according to the weight of the patient is contraindicated but does not necessarily mean that  $\frac{1}{4}$  to  $\frac{1}{2}$  this amount may not be given with impunity. Viewed in this manner many patients present contraindications to full size intravenous injections, while an exceedingly small number will be found who cannot take even a small dose, except those already moribund. Patients with serious complications will usually obtain better results from small doses frequently repeated than from other measures. Patients free from visceral lesions may not be sufficiently robust to withstand the usual dose. It is well to begin the treatment with medium size or small doses and increase the amount as the patient's physical condition improves. It is practically impossible to make hard and fixed rules. The fatalities that result from these remedies depend largely upon failure to recognize the relative contraindications and upon the improper technic. An experienced syphilologist can read the accounts of the fatal results that have followed the injection of salvarsan (we have heard of but few deaths following neosalvar-



san) and often find the cause of death to be: too large doses, too short an interval or a defective technic in the administration. The probable reason why fewer deaths have followed the use of neosalvarsan is that larger doses can be given and so fewer have received overdoses; the interval between treatments is shorter, therefore fewer have had the interval between the treatments too short; those using neosalvarsan developed a proper technic and acquired more skill than obtained when salvarsan was first used and thus there have been fewer defective administrations. There have been deaths reported where the patients were physically normal, in whom the drug alone caused death. These are fortunately rare. After having administered 1,800 intravenous injections of salvarsan and neosalvarsan we have not yet seen a death caused by them.

We started to give the treatment to a patient who had a "cold" but the injection was postponed on this account. Two days later he developed pneumonia and within five days he was dead. Another patient apparently in good health came for treatment, but as his blood tests were negative, he returned without treatment to his home in South Carolina, where he died within ten days. His physicians were unable to determine the cause of his death. In both these instances we would have attributed the death to 606 if this had been administered. Perhaps some of the fatal cases reported may have been due to some such occurrences as those above described.

**HEART LESIONS.**—Myocarditis of syphilitic origin is not of infrequent occurrence and may be attended with endarteritis of the coronary artery. Attacks of true or pseudo-angina, pain over the heart, palpitation, etc., should always be taken as warnings. Valvular lesions with failing compensation may also present absolute contraindication to intravenous injections. If the compensation is good, very small doses may be administered and frequently repeated.

ANEURYSM contraindicates the administration of salvarsan.

RENAL LESIONS.—Unless the disease of the kidney is advanced we have been able to give safely small doses of salvarsan and neosalvarsan though we always urge the patient to drink freely of lithia water so as to dilute well the arsenic as it is eliminated and prevent irritation of the kidneys. Slight albuminuria and casts have often quickly disappeared after the injection. If the albuminuria and casts are marked, preparatory treatment with alkaline remedies, as carbonate of soda or acetate of potash and dietary measures should be instituted. The functional capacity of the kidney should be determined with Roundtree and Geraghty's phthalein test, and unless found to be good, the injections should not be administered. The condition of the arteries, blood pressure, etc., must be considered. Temporary slight albuminuria and slight hematuria may follow injections of salvarsan.

THE LIVER.—The fact that patients are sometimes jaundiced after injections of salvarsan would seem to indicate a certain amount of irritation of the liver. We know, too, that arsenic is eliminated to a considerable extent by the liver. Therefore, in advanced diseases of the liver, even if it is of luetic origin, salvarsan should not be administered except in very small doses, if at all.

IN DIABETES the dose of salvarsan, if given, should be very small.

CEREBRO-SPINAL AFFECTIONS.—It is in these affections that we find certain absolute as well as relative contraindications. In acute cerebro-spinal syphilis and in any advanced condition salvarsan should not be administered. The same may be said of advanced syphilitic meningitis and gummatous affections. Some of these improve wonderfully after injections, but the

increased risk should be kept constantly before us and the dose regulated accordingly. Locomotor ataxia also requires small doses repeated over a considerable period. Irregular pupils, persistent headache, and intracranial pressure are all to be considered as warnings.

The vitality and general health of the patient must be considered regardless of the health or disease of the various organs. When in doubt give very small doses, which may be increased as the patient improves and becomes more tolerant. Err on the side of too small rather than too large doses.

THE EYE.—The bad record left by arsenic in the production of optic atrophy caused much apprehension at first in the use of salvarsan. This fear has diminished as experience has grown. Neuro-recurrences followed the administration of salvarsan and for a time confused the situation. It is now, we believe, generally admitted by those competent to judge that the atrophy caused by atoxyl is quite different from the neuro-recurrences which followed the use of salvarsan. The former is made worse by repeating the injection of atoxyl, the latter is made better or cured by repeated injections of salvarsan. The atoxyl atrophy begins as a grayish discoloration of the papilla with narrowing of the blood vessels and gradually progresses to complete blindness. The color test is negative in the beginning of atoxyl atrophy, while it is positive early in the usual forms of optic atrophy. Schanz has directed attention to the fact in the ordinary syphilitic atrophy the pupillary reaction to light is absent or markedly impaired, while in atoxyl atrophy the reaction to light may remain normal even at times until complete blindness results. All luetic eye affections respond with great rapidity to salvarsan except chronic interstitial keratitis. Advanced optic neuritis and neuro-retinitis have not in our experience been injured by the salvarsan. After it has reached the stage of atrophy, of course no benefit can be expected. The

active lesions such as iritis, choroiditis, iridocyclitis have cleared very promptly in the patients we have treated. We do not fear to treat eye lesions with salvarsan or neosalvarsan where a full course of treatment can be administered. The real danger is from too little which might produce a neuro-recurrence.

**OTITIC INDICATIONS AND CONTRAINDICATIONS.**—Since the advent of salvarsan there has been an increase in the otitic manifestations of syphilis. This, we believe, as previously stated, is due to insufficient treatment.

Beck thinks the syphilitic manifestations which occur during the secondary stage of syphilis have but an indirect relation to it and are catarrhal or suppurative in character. This writer thinks the condition of the labyrinth is the main point at issue as regards salvarsan treatment no matter what the stage of syphilis. If the inner ear is normal, then the treatment may be administered. The ear lesions that occur simultaneously with the secondary symptoms of the skin and mucous membrane present no contraindications to the administration of salvarsan. The nerve-disturbances are to be regarded as partial symptoms of the luetic infection. Beck says that in unaccountable sudden deafness, with or without subjective noises, with symptoms of nerve lesions, in an otherwise healthy individual a diagnosis of syphilis may be made. The Wassermann may confirm the diagnosis, but a negative test does not exclude lues. Yet when these lesions develop four to eight weeks after the injection of salvarsan—at which time they are most likely to occur—Beck thinks salvarsan is contraindicated as we do not yet know the exact role that salvarsan plays in the production of such lesion. We do not agree with him on this point as we have seen strikingly good results follow injections under these circumstances. Such effects could not follow if the disease was a direct toxic result of salvarsan. We think it is an indirect result, which we have already explained under neuro-

recurrences. Deafness in hereditary syphilis is more satisfactorily treated with salvarsan than with mercury, if as Beck says: (1) the infection be caught in its incipient stage; (2) the hearing for the conversational voice has not decreased beyond 1 meter; (3) the vestibular apparatus responds to normal stimuli; and (4) if the patient be young. Total deafness cannot be expected to respond to salvarsan and other antisyphilitic treatment.

SYPHILIS OF THE THROAT AND NOSE respond with remarkable rapidity to salvarsan treatment and present no contraindications.

LUETIC STENOSIS OF THE LARYNX requires more care, as a Jarisch-Herxheimer reaction may cause swelling or edema and troublesome or complete obstruction to the respiratory tract. Where such a possibility exists the patient may be placed in a hospital and an intubation outfit should be provided so that a tube may be inserted in case it is needed.

THE JARISCH-HERXHEIMER REACTION is a temporary intensification of the syphilitic rash which develops soon after the injection and may last for several days. The shooting pains of locomotor ataxia may be made temporarily worse in a similar manner. This reaction is thought to be due to an inadequate dose which momentarily aggravates the lesions by stimulating the growth of organisms. It may also be due wholly or in part to local action of the endotoxins liberated by the destruction of the spirochetes.

An arsenic exanthem or erythema may be produced soon after the injection or as late as ten days. The late reaction may be attended with an acute inflammation of the throat, fever, malaise, etc.

ELIMINATION.—After the intravenous injection no arsenic can, as a rule, be detected in the urine after the third or fourth day. Elimination is slower if the remedy be injected intra-

muscularly or subcutaneously and may continue from 10 to 14 days. Occasionally, considerable delay in the excretion may occur. Red blood cells and a slight albuminuria may be found in the urine for a few days after the intravenous injections.

When the disturbance produced by the salvarsan or neosalvarsan has subsided the patient experiences a feeling of well-being, the nutrition is improved, as there is usually a gain in weight if the patient is reduced on account of syphilis. This gain may at times be as much as 30 to 50 lbs. The patient becomes more active and cheerful and not infrequently there is a gratifying improvement in the sexual power.

PREPARATION OF SALVARSAN AND NEOSALVARSAN.—Too much importance cannot be placed upon the preparation of these remedies according to rigid rules of asepsis and in an exact chemical manner. Undoubtedly not an inconsiderable portion of the ill effects produced by these remedies have been due to errors in preparation and dosage and in deciding upon the proper interval between injections. The technic of the administration has often been at fault. It should be remembered that neutral solutions of 606 cannot be made as it is only soluble in acid or alkaline media. If dissolved in a physiologic salt solution salvarsan is acid, it should be neutralized for intramuscular injection or rendered alkaline for the intravenous injection.

INTRAMUSCULAR INJECTIONS.—There are many important reasons why these remedies should not be administered other than intravenously, except to babies. Aside from the unnecessary pain caused when given intramuscularly or subcutaneously, unabsorbed masses may remain for many months and thus make subsequent injections hazardous. Many of the neuro-recurrences have followed such injections. We can never be sure how much of the drug may be absorbed when given in this way. While, at times, brilliant temporary results

may follow these injections, too much uncertainty exists to recommend them. Not infrequently the indurated mass may undergo necrosis and leave troublesome and painful lesions. Suspensions of salvarsan or neosalvarsan in oil are less potent than when given intravenously and are therefore inadvisable. Neosalvarsan is neutral and needs only to be added to 20 c.c. of sterile water for intramuscular injections. Salvarsan, though, requires accurate neutralization and careful testing with sterile litmus paper until the desired result is obtained. Eleven minims of a 15% solution of caustic soda should be added 0.6 of a gram of salvarsan in a sterile mortar and more of the diluted caustic soda solution or diluted glacial acetic acid added until exact neutralization results. It is then mixed with 20 c.c. of physiologic salt solution and should be administered without delay. The acid solution of 606 has been injected intramuscularly but is more painful than the neutral suspension and less effective than the intravenous injection.

TECHNIC OF INTRAMUSCULAR AND SUBCUTANEOUS INJECTIONS.—The patient reclines face downward upon an operating table, the buttocks are exposed and the one to be injected is painted with tincture of iodine, 10%, and surrounded with sterile towels. Two 17-gauge needles two and one-half or three inches long are then quickly inserted well into the gluteal muscles. If blood escapes from either it shows that a blood vessel has been entered and should be readjusted. The salvarsan suspension or neosalvarsan solution, both being neutral, should be injected by means of a 20 c.c. Record or Leur syringe. About half of the desired amount should be injected through each needle. The upper outer part of the gluteal muscle contains few nerves and blood vessels and therefore is a good point for making the injections. Moderate massage after the injection to spread the remedy throughout a wider area favors a more satisfactory absorption. The patient should remain

quiet until after the severe pain has subsided which may require from a few days to a week. A few c.c. of a 2% solution of novocain injected five minutes before the salvarsan or neosalvarsan lessen the immediate pain but patients are quite variable in their complaints, some notice but little discomfort while others complain bitterly. The chief difficulty is that subsequent treatment may have to be postponed on account of the unabsorbed masses. We do recommend this method of treatment.

THE SUBCUTANEOUS INJECTIONS have all of the disadvantage of the intramuscular and none of the advantages of the intravenous injections. The technic is like the intramuscular except it is injected under the skin around the lower angle of the scapular.

SUMMARY.—Great advances have been made in the treatment as well as diagnosis of both active and latent syphilis. Notable improvement began with the arsenic preparations of atoxyl, arsacetin and arsenophenylglycin, and finally resulted in the discovery of salvarsan and neosalvarsan, which were found to have a selective action on spirochetes. Neosalvarsan is a neutral, easily soluble formaldehydesulphoxyl of salvarsan, less toxic than salvarsan but also somewhat less effective though better for intramuscular injections especially for babies who cannot receive intravenous injections. These remedies are contraindicated in patients with serious organic affections, especially lesions of the brain. Ordinarily the contraindications are relative rather than absolute; that is, small doses may be administered and repeated until the patient's physical condition will permit of larger doses. STUDY WELL THE CONTRAINDICATIONS.

Before taking salvarsan or neosalvarsan patients should have the bowels well evacuated, and they should drink, and continue to drink, large quantities of water or lithia water so as



to dilute well the medicine as it is eliminated in the urine and thus prevent irritation of the kidneys.

Intramuscular injections are to be recommended for babies only as the masses left at the site of injections may interfere with subsequent treatment on account of the poor absorption. Subcutaneous injections are still less desirable. Neosalvarsan is preferable to salvarsan for intramuscular treatment as it causes less pain and is better absorbed. The treatments should not be repeated until most of the mass has been absorbed.

## CHAPTER XXXIV

## INJECTION OF SALVARSAN AND NEOSALVARSAN

FINANCIAL ARRANGEMENT, A LESSON, TECHNIC, PREPARATION OF  
ALKALINE SOLUTION, TECHNIC OF PREPARATION AND ADMIN-  
ISTRATION OF NEOSALVARSAN, METHOD OF INSERTION  
OF NEEDLE IN VEIN, APPARATUS, POSITION, TEST  
FOR PROPER ENTRANCE, INJECTION, DOSAGE,  
MERCURY, SUMMARY

THE FINANCIAL ARRANGEMENT.—The charge for administering this treatment should never be so much for each injection but for the course of treatment of syphilis and for the subsequent observation to determine if the cure is lasting. All should be informed that, at the present, nothing but the time test can be accepted as proof of cure. We have not made additional charge for subsequent examinations and treatment except for the cost of the salvarsan or neosalvarsan. This agreement was made in order that we might keep closely in touch with our patients and thus see the majority of recurrences or unsatisfactory results if they should develop. As all but two of the patients treated have been in private practice, we think that the small number of recurrences seen may be taken to mean that the majority of the patients who have not reported have remained free from evidences of the disease. Most of the patients have written, or have returned at intervals for examinations and for blood tests. In the course of these examinations we have occasionally observed recurrent lesions, glandular enlargements or positive Wassermann tests after what we first thought to have been an adequate course of treatment.

A VERY IMPRESSIVE LESSON was taught one of us by the first patient he saw treated with salvarsan. The patient desired to receive the treatment before the remedy had reached this country, so he was taken to Berlin, where a well-known physician administered a subcutaneous injection of salvarsan. All of the manifest lesions quickly disappeared and the patient gained about 20 pounds in weight. So well did he feel that he would not inconvenience himself by coming for a blood test or examinations. In about three and a half months a profuse macular rash developed upon his body and limbs and many mucous patches appeared on his tongue and buccal cavity. The throat, too, was much inflamed. An intravenous injection of salvarsan was administered and within a few days all of the lesions had healed quite as wonderfully as they did after the first treatment. Likewise three facts were indelibly impressed upon us: first, that a single dose could not be depended upon; second, that the intravenous method was much superior, as subsequent injections could be given with the assurance that most of the remedy had been eliminated, as no masses were left as in the subcutaneous and intramuscular methods; third, that the spirochetes are not rendered immune to salvarsan when they are protected and escape its destructive action. This recurrence developed during the first month of our use of salvarsan and showed in a striking manner both the value and necessity of repeating the injections and thus we were disillusioned almost at the beginning of our use of salvarsan of the hope that a single injection could be relied upon to effect a cure. From then on we urged that injections be repeated as needed until the cure was complete. Learning early the value of repeated injections we think has been the cause of our freedom from neuro-recurrences, which to us seem due to insufficient treatment. This at least seemed clearly proven in the only instance in which we have seen anything resembling optic nerve recurrence. This case was reported in detail before the Medical

Association of Georgia, April, 1912. The patient was thought to be in the beginning of the secondary stage with a very faint macular rash over the body; the history, however, was not clear. An oculist demonstrated a beginning optic neuritis 21 days before the first injection of salvarsan was administered. The dose was repeated in a month. All external evidence of disease disappeared. Five weeks later typical optic neuritis developed. More salvarsan was given with mercurial inunctions and potassium iodide, which caused distinct improvement in the vision of the diseased eye. Treatment was neglected later and the neuritis grew worse; more treatment made it better. It was clearly of syphilitic origin, and apparently in some manner sensitized by the inadequate dosage of salvarsan.

The danger of small doses without repeating them was also shown in another instance where only 3 gram was administered (on account of a mitral regurgitation) to a syphilitic with optic neuritis; the vision was much worse within two weeks. Two large doses were then administered, which resulted in improvement in the vision to the point it was before the treatment; it then remained stationary. A few ear lesions have developed in our patients after treatment with salvarsan, but more of the remedy and mercury have restored the hearing to normal.

THE TECHNIC OF INTRAVENOUS INJECTIONS.—All who have had any considerable experience with salvarsan and neo-salvarsan admit the necessity of repeating the injections if uniform and permanent results are to be expected; therefore we should make the administrations as pleasant and painless as possible in order that the patients will readily return for subsequent treatments to complete the cure and prevent recurrences. We believe, furthermore, that neuro-recurrences can be avoided entirely if the injections are repeated at proper intervals until an adequate course of treatment has been ad-

ministered. The freedom from the nerve affections in our patients so far treated has been due, we think, to the fact that all patients were advised to follow even the most satisfactory temporary cures with subsequent injections to clinch the good obtained, and thus if possible render it permanent. That the majority have subsequently been cured we have no reason to doubt, though all have been urged to report, from time to time, for two or three years for Wassermann blood tests and careful physical examinations.

**PRELIMINARY TREATMENT.**—An evacuation of the bowels should be secured the day before the treatment and overeating should be avoided for a few days. The patient should drink freely of lithia water for the day preceding and a week after the injection. If the patient is "bilious" the administration should be postponed until suitable remedies have corrected the intestinal toxemia.

**PREPARATION OF THE ALKALINE SOLUTION FOR THE INTRAVENOUS INJECTION.**—All of the apparatus used should be sterilized by boiling or by heating in an autoclave to 25 or 30 lbs. pressure. The ampules containing 0.6 salvarsan, with the file, are placed in 95% alcohol for  $\frac{1}{2}$  hour. The needles and tubes should be boiled just before using them. The salvarsan is placed in a mortar, 23 minims of a 15% solution of caustic soda is added and mixed with a pestle until the salvarsan is in a solution. It is then mixed with 50 to 150 c.c. of sterile physiologic salt solution prepared with freshly distilled water or pure tap water that has been boiled and sterilized in an autoclave. We prefer the latter because distilled water is likely to contain chemical substances which cause a reaction. What these substances are we cannot say.

The tap water of Atlanta boiled and then sterilized in an autoclave produces less reaction; this fact we know.

The drain bottles and tubes are washed out with filtered and sterile water and physiologic salt solution and the salvarsan solution are filtered through closely woven silk which has been boiled or sterilized in the autoclave.

**TECHNIC OF PREPARING AND ADMINISTERING NEOSALVARSAN.**—For intravenous injections, which is the best way to give it, neosalvarsan has but to be mixed with sterile freshly distilled or well boiled tap water, 25 c.c. being required for each 0.9 gram of neosalvarsan. It comes quickly into solution and should not be shaken or allowed to stand, but should be administered immediately. The temperature should not be above 70° F. and under no circumstances should it be warmed.

For the intramuscular injection of neosalvarsan it may be given in a 5% aqueous solution. Five c.c. of  $\frac{1}{2}$  per cent. solution of novocain may be injected through the needle to prevent immediate pain and after a few minutes the neosalvarsan may be injected. The best site for the injection is the upper outer quadrant of the buttocks.

For small babies the dose should be about 0.05 gram. The intramuscular injections are recommended for babies and children. Mercurial inunctions should be used simultaneously and until all clinical evidences of the disease disappear and until the Wassermann test remains negative.

**METHOD OF INSERTING THE NEEDLE IN THE VEIN.**—Tell-tale scars in the region of the elbow where incisions were made to insert the needle into the veins, in case they were too small for the expeditious insertion of the needle directly into them, soon caused patients to complain bitterly that they could not roll up their sleeves, bathe in the athletic clubs, or expose their arms at home without proclaiming the fact that they had syphilis.

To overcome the difficulty of an accurate introduction of the needle in patients who were fat or had small veins various expedients have been tried: first, we used a small, short trocar and cannula, pulling the skin from over the vein, while the insertion was made through the skin, in such a manner that when the skin was released and the trocar removed, the cannula came over the vein and enabled us to pass the needle through it into the vein without the pressure otherwise necessary to carry the needle through the skin. The cannula was not introduced into the vein but only down to it. This method led us later to insert the needle through the skin while it was pulled aside, not trying to enter the vein until the skin had been previously punctured. Finally we devised a small *stiletto* which may be used in the following manner: The skin is pulled aside, so as not to enter the vein, and a small hole is pushed in it so as to make a little "window," directly over the vein when the skin is released. The hole should be about twice the diameter of the needle to be inserted; rarely does even a drop of blood escape from this slight wound, as the tissues of the skin are merely pushed apart. With the vein well distended, and often visible through this hole, it is comparatively easy to insert the needle through the anterior wall into the lumen of the vein. Without some such opening the pressure required to carry the needle through the skin and wall of the vein at the same time, flattens the vein to such an extent that the needle is likely to pass also through the posterior wall. We have now administered 1,650 consecutive intravenous injections without making a single incision through the skin.

A tourniquet is adjusted above the elbow so as to well distend the veins of the forearm. It is important to have a tourniquet that is easy to adjust and one that can be quickly released with one hand in order not to pull out the needle in the effort to remove the tourniquet. The most satisfactory one we have

used is the retention catheter, which with one or two turns around the arm gives the desired constriction; it may be easily released by pulling out the end which has been tucked under one of the turns.

**APPARATUS.**—The apparatus we formerly used consists of two 500 c.c. drain bottles connected by rubber tubes to a three-way cock, into which an 18-gauge needle is screwed. A new sharp needle with rounded edges is preferable. Bulbous glass connecting tubes are placed about two inches from the stop-cock and plain straight connecting tubes about 12 inches from the drain bottles. Bulbous glass tubes near the stop-cock are recommended for the following reasons: they act as traps and catch bubbles of air that might by chance be in the tubes; while a little air would probably do no harm if carried into the vein, it is just as well to prevent it; especially as the inward flow of the saline mixed with blood is more clearly seen through the bulbous than the straight tube. The glass inserts near the bottles are for the purpose of disconnecting the tubes so that they may be boiled without disturbing the solution bottles when more than one treatment is given. A clamp is also placed on each tube near the bottle. By the time the next patient is prepared all contaminated parts of the apparatus have been thoroughly boiled and the solution has only to be poured through the filters into the bottles.

Recently we have devised a 50 c.c. syringe with the needle offset from the center so as to facilitate its easy introduction parallel with the vein. This has entirely supplanted the gravity method, as its use is much simpler and easier. (See Simplified Technic.)

**POSITION.**—The patient reclines on an operating table and the arm is placed at the right angle to his body, on a small table covered with a sterile cloth. The largest vein is selected and a point over it is cocainized by injecting a few drops of



cocaine into the skin, not under it; this renders the remainder of the operation practically painless. A hole is now pushed through the skin, as previously described, and the needle, connected to the three-way stop-cock, is inserted into the vein. It is first pushed straight downward until the point is engaged in the wall of the vein, then the needle is lowered

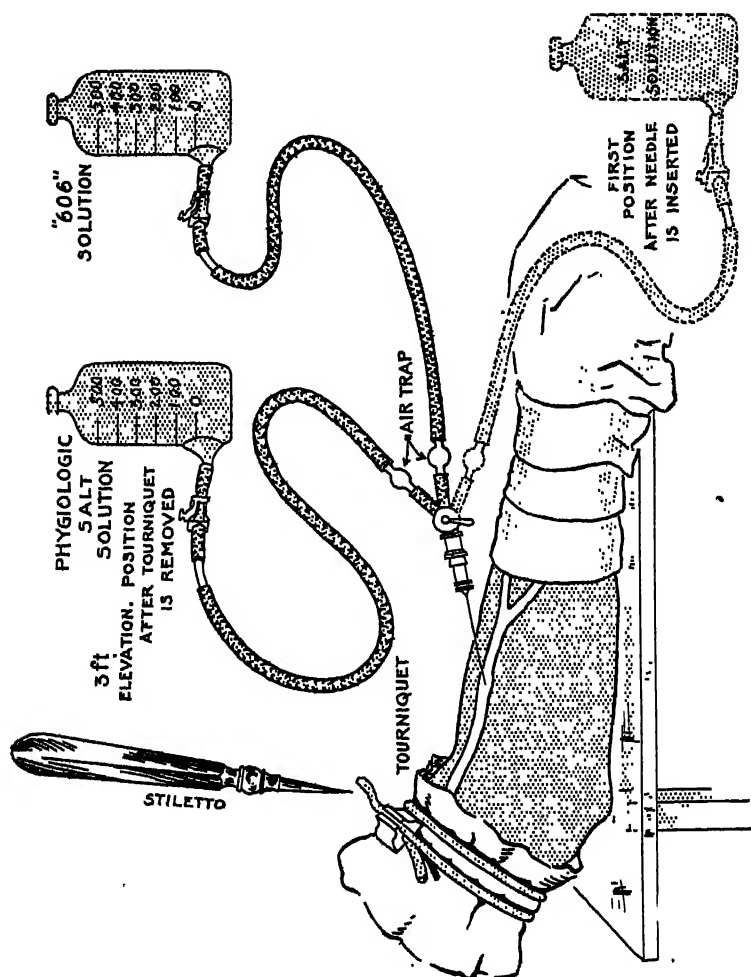


Figure 104.—Aparatus for giving salvarsan and neosalvarsan.  
We now use the 50 c.c. syringe much more frequently than this method.

and further inserted while it is nearly parallel with the vein. This lessens the danger of going through the opposite wall of the vein.

**TEST TO DETERMINE IF THE VEIN HAS BEEN PROPERLY ENTERED.**—The drain bottle containing physiologic salt solution is now lowered below the arm, and the stop-cock so adjusted as to open the vein into the tube leading to it. If the vein has been properly entered, the blood quickly flows into the bulbous glass connecting tube. The tourniquet is then removed and the bottle placed three feet above the patient's arm. The rapidity of the inward flow of the bloody salt solution enables one to tell immediately if the needle is in the lumen of the vein. No swelling occurs at the site of the injection.

**THE INJECTION.**—If all goes well the stop-cock is adjusted so as to allow the salvarsan solution to flow into the vein; with three feet of elevation this flows in by gravity in five or six minutes. Pain and swelling at the point of injection always indicate a faulty adjustment of the needle, and a further effort should be made until it flows perfectly.

When the proper dose has been given, the stop-cock is turned so as to allow a little salt solution to flush out the needle, which is then withdrawn and the opening in the skin compressed with the sterile gauze until the slight bleeding is stopped. The puncture in the skin is sealed with collodion. The patient, who has been drinking freely of lithia water for several hours previous to the operation, is instructed to continue it for a week. He is allowed to go home, advised to make the next meal a light liquid one and to remain quiet for 12 to 24 hours.

While the solutions are flowing into the veins the bottles may be placed on a small shelf, covered with a sterile towel, three feet above the patient's arm; or if preferred they may

be suspended upon the ordinary irrigating stands, usually part of the operating room equipment.

AFTER TREATMENT.—The patient should remain quiet for 24 hours and continue on a light diet. Rise of temperature and a chill may be expected in those patients with more or less active syphilitic manifestations. Subsequent injections will not be so disturbing. For this reason we administer a small dose of salvarsan or neosalvarsan at first, not hoping to kill all the spirochetes at once, but only to obtain a satisfactory start. No medication is necessary to relieve the nausea, vomiting, fever, chill, diarrhoea, etc., which are usually transient and disappear of their own accord.

When the lesions are indurated we know of nothing so important, as to apply heat in order to produce hyperemia of the diseased area and thus bring the greatest possible amount of salvarsan to the point where it is most needed. Early in our work we experienced considerable difficulty at times in securing the softening of the indurated chancres. Since we began to apply heat for from four to six hours daily for the first three days after the treatments, there has been quite evident hastening of the absorption of the induration. This is especially true in those where healing of the chancre has not occurred some time previously. The long-standing, apparently fibrous hardness is always slower in disappearing.

For chancres on the penis we usually advise the patient to soak the penis in a pitcher of water as hot as can be borne for several hours daily for three days. Hot water should be added frequently to keep up the desired temperature. Hot fomentations may be used instead, if the lesions are so situated that they cannot be immersed in hot water. In some instances Bier's hyperemic suction cups applied from time to time might be even more useful than hot applications in producing the hy-

peremia. We are convinced that the patients who have followed assiduously the suggestions to bring a free supply of blood to the diseased parts have made more rapid progress than those who neglected it. When seen early, and such an operation seemed feasible, the chancres have been excised.

**DOSAGE AND REPETITION OF TREATMENT.**—Salvarsan requires unusual accuracy in determining the proper dose. This can only be ascertained after a careful physical examination; from this, when considered with the weight and vitality of the patient, an estimate of the dose then can be made. The amount should always be smaller when there is a brain or spinal lesion. If there is doubt as to the ability of the patient to withstand the usual quantity of the drug, a small dose should be administered and another somewhat larger dose given within one or two weeks, according to the reaction. If the improvement is satisfactory, still larger doses may be given at suitable intervals until all manifestations of the disease have disappeared. It is upon the repetition of the treatment that success and freedom from neuro-recurrences will depend. If the remedy is properly administered the patient will rarely object to further treatment, as the pain will scarcely ever be as much as that of an intramuscular injection of salicylate of mercury. If the patient is in good health and a full size dose is administered, it should be repeated every one or two weeks until six or more injections have been administered. While many patients appear to be cured by a smaller number of injections, one cannot feel secure until a full course has been given. Harm is much more likely to come from too little than from too much provided it is properly given and repeated at suitable intervals. The treatment should be repeated and supplemented with mercury as described under this head, until the provocative blood test remains permanently negative. An interval of three or four months should be allowed to intervene

after all lesions have cleared and after the blood test becomes negative and then the provocative test again made regardless of the apparent cure.

The average dose for adults varies from 0.05 to 0.1 gram for each 30 pounds of weight. Albuminuria need not prevent salvarsan being given, provided the dose is small and a large quantity of water is taken daily for a week to dilute it as it is eliminated in the urine. In our patients the albuminuria has so often quickly disappeared after treatment with salvarsan that we are of the opinion that syphilis is a more frequent cause of renal affections than is generally supposed. Serious heart and lung diseases should contraindicate the use of salvarsan except in the smallest doses administered with the greatest precautions.

**THE SIMPLIFIED ADMINISTRATION OF NEOSALVARSAN.**—Neosalvarsan may be administered intravenously with a 20 c.c. Luer syringe. This stronger solution is injected slowly, allow-

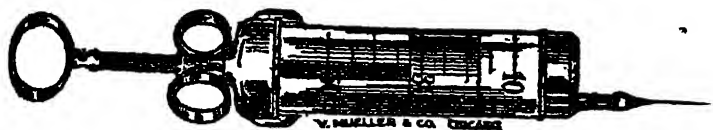


Figure 105.—Fifty c.c. syringe for intravenous injections of salvarsan or neosalvarsan.

ing the blood to dilute it as it passes into the circulation. The technic is very simple: after preliminary cleansing the tourniquet is applied and a drop of 2% alypin or cocaine is injected over the vein. The patient is then requested to grip his hand so as to further distend the vein. When the needle has been inserted into the lumen of the vein, a small amount of blood is forced back into the syringe and thus acts as a test, showing that the needle has been properly inserted. The tourniquet is removed without disturbing the position of the needle and the neosalvarsan is slowly injected, about four minutes

being consumed during the injection. In this manner a smaller quantity of water is required than by the usual technic. It seems hardly necessary to say that the same surgical asepsis is necessary with this method that is required with the usual intravenous injections.

Concentrated solutions of salvarsan may cause phletitis, consequently it should not be administered in less than 50 c.c. of water. We have devised a 50 c.c. syringe with the needle offset from the center so that it may be inserted parallel with the vein. An ordinary 22-gauge standard hypodermic needle may be used, about  $\frac{3}{4}$  or 1 inch long. Such fine needles may be inserted without sufficient pressure to flatten the vein, and the danger of passing the needle through the posterior wall is thereby minimized. Very satisfactory distention of the veins may be secured by making a few turns around the arm with a soft catheter or a short rubber tube. When released this quickly unwraps itself so that the needle is not likely to be disturbed during the manipulation. The unwrapping of the tubing is greatly facilitated by having the table only under the forearm, leaving the arm free.

**MERCURY.**—The question as to when mercury and iodide of potash should be administered is of great importance and as yet cannot be said to be finally settled as to how and when it should be administered with salvarsan or to supplement it. In our own work when patients could report for examinations after all lesions have healed and after what we thought to have been an adequate course of salvarsan, we have not administered other remedies except where it seemed indicated to assist in rendering the blood test negative or in clearing some unusually stubborn syphilitic manifestation. Believing as we do that salvarsan is a much more potent remedy in combating syphilis than is mercury, and being more pleasant for the patient to take and much less dangerous than the uncured

disease, we have felt that better results would follow repeated injections of salvarsan than the mixed treatment. If our patients were not cured with salvarsan then we believed they need not less than a year or two of mercury. This, of course, did not seem indicated for the majority, therefore we did not wish to confuse ourselves by giving mercury to all and make the results of salvarsan appear better than they really were. Mercury tends to mask symptoms and to keep the disease temporarily in abeyance, and may make the blood test temporarily negative. If the patient cannot report for examinations he should be given mercury after even what may seem an adequate course of salvarsan or neosalvarsan. Active treatment with all of these remedies affords the chief precautionary measure against neuro-recurrences.

We recommend to those with a limited experience in dealing with syphilis and for all patients who cannot be closely observed for two years, that mercury be used as a routine to supplement the salvarsan and neosalvarsan.

#### OPPONENTS OF SALVARSAN AND NEOSALVARSAN.

A more or less limited number of physicians have reported a comparatively large number of accidents after the use of these remedies. This applies particularly to the clinic of Finger in Vienna and to certain French physicians of whom Gaucher is the leader.

Just why certain men and certain localities should have an unusually large number of unfavorable bi-effects has not been demonstrated. Among the toxic and fatal effects reported recently by Gaucher the following may be taken as an example. Their manifestations were:

1. Vertigo, headache, and unilateral deafness three months after three injections of salvarsan; after four injections of calomel the vertigo disappeared, but the deafness and headache remained.

2. Another case of unilateral deafness three months after three injections of salvarsan.

3. A case of death six days after the third intravenous injection of salvarsan. The patient was a young man aged twenty-one, in robust health, and the symptoms were retention of urine and coma.

4. Retention of urine, albuminuria, icterus, and uremic symptoms, which only yielded to blood letting, in a healthy young man of twenty, who had a chancre three months previously.

With regard to neosalvarsan, Gaucher reports two cases: (1) A fatal case in a young woman, five months pregnant, who died, after convulsions and coma, two days after the second injection of neosalvarsan (0.6 gram). (2) A case of paraplegia, occurring four days after an injection of neosalvarsan in a young girl with ocular lesions due to heredo-syphilis. Gaucher considers the paraplegia due to the toxic effect of arsenic. He also reports several cases of severe recurrences after salvarsan, including the case of a man who had chancriform ulcerations in the same places as the original chancre, followed by recurrent roseola, adenopathy, mucous patches and alopecia, five months after injections of salvarsan and six months after the first chancre.

#### CAUSES OF DEATHS FROM SALVARSAN.

Aside from the fatalities resulting from overdoses of salvarsan, or injection following each other too closely, or from errors in its preparation or administration, there are on record a number of undoubted instances where death followed which could not be attributed to any of the above causes, or to a debilitated condition of the patient. While the obscure deaths may properly be classed as purely salvarsan fatalities, there are many points about which we still know little.



It seems to be due largely to certain peculiarities existing in the patients themselves, as salvarsan from the same supply, after its preparation, given to other patients was not followed by untoward symptoms. Furthermore, the fact that millions of doses of salvarsan have been administered without harmful effects eliminates a purely toxicologic explanation of such fatalities.

The size of the doses, too, seems not the main factor, as Weschselmann has reported an instance where a fatal ending followed two small doses of salvarsan, 0.1 and 0.2 gram. Most of the fatalities have followed the usual dose. The cumulative action as the cause is not justified by facts, as the deaths have usually followed a total amount of 0.3 to 0.8 of a gram. Idiosyncrasy does not afford a satisfactory explanation, the deaths, as a rule, followed the second or subsequent injections. The question of hypersensitiveness does not seem to afford a satisfactory explanation of these occasional inexplicable deaths.

A peculiar fact is that a considerable number of post-mortem findings reveal a hemorrhagic encephalitis, though the brain may be entirely free from luetic or parasymphilitic changes. Weschselmann asserts that the neurotoxic action is quite untenable because of the fact that even in the presence of hemorrhagic encephalitis the brain tissues are not damaged, but only the blood vessels. At present we are unable to explain these unfortunate and unforeseeable fatalities which now and then follow the intravenous injection of salvarsan.

Weschselmann thinks that insufficiency of the kidneys is the chief factor in salvarsan fatalities, rather than hypersensitiveness of the brain as some observers have claimed. Stimulation of the renal function and the free passage of urine before and after the intravenous injection of salvarsan and neosalvarsan therefore is a matter of the greatest importance. We attribute the absence of fatalities in our work to the insist-

ance upon the patient drinking freely of lithia water, and to the administration of small doses when in doubt as to the patient's ability to withstand an ordinary dose.

That there is a certain amount of danger in the administration of salvarsan and neosalvarsan no one thoroughly conversant with facts can deny. This danger, however, is much less than is the danger of uncured syphilis, or even the best cures ascertainable with other remedies. A study of paresis, tabes, aneurism, etc., will soon convince one of the dangers inherent in the older methods of treating syphilis, as well as the harmful effects of mercury. Many cases are on record where sudden death followed injections of this remedy. We are firmly of the opinion that the patient assumes the least risk who receives repeated small or medium doses of salvarsan—supplemented with mercury and iodides according to the conditions and requirements, until the Weschselmann reaction remains permanently negative. The presence of uncured syphilis is to be regarded always as a graver menace than treatment with salvarsan and mercury.

**SUMMARY.**—Successful treatment with salvarsan and neosalvarsan depends upon the expeditious and painless administrations of these remedies so that the patient will not object to their repetition, for upon this we must rely to effect a lasting cure.

The charge should be made for curing the syphilis rather than so much for each injection, otherwise the patient may discontinue treatment and observations before proof of the cure has been obtained. Salvarsan is administered intravenously in a weak alkaline solution. About 23 minims of a 15% solution of caustic soda will be necessary to secure this alkalization of 0.6. The strength of caustic soda varies at times, that marketed by some manufacturing chemists being stronger than

others; therefore when using a new solution the smallest amount should be employed that will bring the salvarsan into solution.

Neosalvarsan has only to be mixed with 20 to 100 c.c. of sterile freshly distilled or tap water, while salvarsan is to be dissolved in 50 to 150 c.c. freshly prepared, a sterilized physiologic salt solution made with recently distilled, sterile or tap water. The solutions are then filtered and administered at room temperature. The patient's arm is well scrubbed with 95% alcohol and covered above and below the elbow with sterile towels. A tourniquet is applied and the arm allowed to hang over the edge of the table so as to distend well the veins. A large one is selected and the skin over it cocainized with one or two minims of a 2% solution of cocaine. The needle is inserted into the vein while the patient grips his hand. The bottle containing the saline solution is lowered and the stop-cock so adjusted as to allow the blood to flow into the saline solution, which is then elevated. If we then have a free inward flow without pain or swelling, the stop-cock is changed so as to allow the salvarsan or neosalvarsan to flow into the vein. The patient avoids active exercise for a few days and continues to drink freely of water. The next meal should be a light one.

## CHAPTER XXXV

## THE WASSERMANN REACTION

BY J. EDGAR PAULLIN, B. A., M. D.

EXPLANATORY, TECHNIC OF REACTION, SUSPECTED SERUM, COM-  
PLEMENT, ANTIGEN, WASHED HUMAN RED CELLS,  
ANTI-HUMAN AMBOCEPTOR  
AND SUMMARY.

EXPLANATORY.—In accord with Ehrlich's theory of immunity, the body fluids contain certain substances which prevent infection. These protective substances normally present in the body-fluids are spoken of as anti-bodies, and are commonly known as antitoxins, agglutinins, lysins, precipitins, opsonins, etc. The amount of anti-body content in the blood of an individual varies from time to time, and in different members of the same species.

When an animal is experimentally inoculated or becomes infected with a protein substance foreign to its body, there develops in the blood of this animal certain substances which are antagonistic to and have the power of destroying the protein injected either in vitro or in vivo. These substances are in many respects similar to those normally present in the body and likewise are known as anti-bodies. The substances used for the injection in producing anti-bodies are known as antigens. Anti-bodies are either simple or complex; the simple type is well illustrated in diphtheria antitoxin, whereas the more complex type known as an amboceptor is an anti-body which can act antagonistically against its particular antigen only in the presence of another substance which is known as complement.

To illustrate the production of anti-bodies we will make use of the following experiments: A rabbit is given intraperitoneally or intravenously five to six injections of washed human red cells; an interval of five or six days occurs between each dose administered, and each succeeding dose contains a greater number of red cells than the previous one. Ten days or two weeks after the last injection the animal is bled and the serum collected; it will be found, when this serum is greatly diluted with normal salt solution, and mixed with human red cells in a test tube, that it has developed an entirely new property, viz., the red cells after being in contact with the diluted serum for a short space of time have disappeared, and the fluid will have a clear, transparent, reddish color. The cause of this reaction is the presence in the rabbit's serum of a substance which is known as an amboceptor, and which was produced by inoculating the rabbit with washed red cells. In many instances, provided the rabbit survives the period of inoculation, it will be found that 0.1 c.c. of the rabbit's serum when diluted 1-1000 will destroy 0.5 c.c. of a 5% solution of human red cells. This particular amboceptor is specific for human blood; in other words, should we mix in the same dilution this amboceptor with the washed blood from the guinea pig, sheep, dog, ox, horse, etc., it will be found that the red cells of these various animals will undergo absolutely no change. If the rabbit's serum is heated to 55°C. for thirty minutes, and then mixed with human red cells as in the first experiment, it will be found that no change in the corpuscles takes place; this is occasioned by the fact that the third substance necessary for the reaction, viz., the complement, which is normally present in the rabbit's serum, has been destroyed by heating, or the serum becomes inactivated. This mixture may again be reactivated by adding to it a small amount of guinea pig serum or of fresh rabbit serum which has not been heated. The complement then is a neces-

sary substance to complete the union between the specific anti-body (amboceptor) and antigen (red cells). The complement because it does not resist heat is spoken of as thermolabile, whereas the amboceptor, or anti-body, which is not affected by heating to 55°C. for thirty minutes, is spoken of as thermostabile.

The same experiment repeated with bacteria gives similar results. By injecting a rabbit with frequent and large doses of typhoid bacilli at properly spaced intervals and waiting, then ten days or two weeks after the rabbit has received five or six doses of this particular antigen, it will be found that the rabbit will respond to these injections by developing in the blood an amboceptor which, when mixed outside the body with typhoid bacilli in the presence of complement, will likewise accomplish a rapid destruction of this organism.

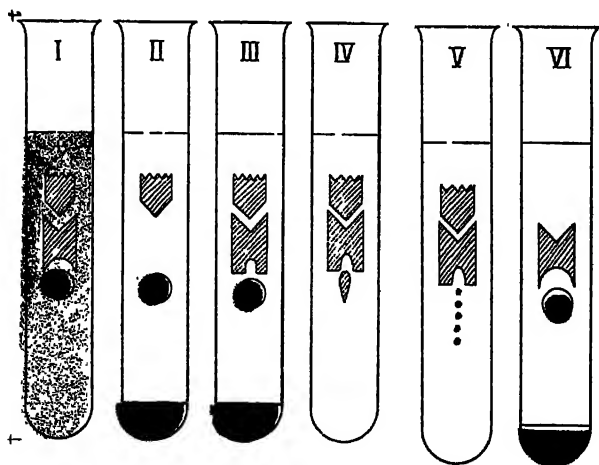


Figure No. 1.

Figure 1 is used to illustrate the reaction which occurs in tubes containing various mixtures of the above reagents. In tube No. 1, we have placed complement, anti-human amboceptor and human red corpuscles; these three substances unite, and as a result of the union the red cells are destroyed,

undergoing dissolution (haemolysis). In tube No. 2, we have placed complement and red cells; no reaction occurs for the reason that the intermediate body (amboceptor) which is necessary to complete the union between these two substances is not present, consequently the cells precipitate to the bottom of the tube and the supernatant fluid is quite clear. In tube No. 3, we have placed complement, anti-human amboceptor and ox corpuscles; no change occurs for the reason that the ox corpuscle has not a suitable receptor to unite with the anti-human amboceptor, consequently the cells precipitate to the bottom of the tube. In tube No. 4, we have placed complement, typhoid anti-body and typhoid bacillus; union at once occurs between these three bodies, and dissolution of the typhoid bacilli takes place. In tube No. 5, we have placed complement, typhoid anti-body and streptococci; the streptococci will, on standing, precipitate and remain unchanged for the reason that this organism does not possess a suitable receptor to unite with the typhoid amboceptor to complete a union of the three substances causing a destruction of the organism. In tube No. 6, we have placed inactivated anti-human amboceptor and washed human red cells; no change will be observed in the mixture because of the absence of the third essential substance in completing the union, viz., complement. The figure then illustrates (a) the specificity of anti-bodies, (b) visible changes in the mixtures as a result of the action of the anti-bodies, (c) the necessity of the presence of complement in the reaction.

When an individual becomes infected with the spirochaeta pallida, the organism of syphilis, the body responds to this infection just as the rabbit responded to the injections of red blood cells, though the response is not so intense. Anti-bodies are thrown into the circulation in an attempt to destroy and to prevent the invasion of the spirochaeta; in other words, the pro-

fective forces of the body are called upon to resist the invasion of the foreign organism, and this response is manifested in the circulating blood by the presence of syphilitic antibodies. The principle upon which is based the Wassermann reaction is an attempt to detect in the blood of an individual having this disease the presence of these anti-bodies. For sometime after the publication by Wassermann, Neisser and Bruck of their method of performing this test, it was generally accepted that the reaction depended on the power of the syphilitic blood to fix complement when mixed with syphilitic antigen; the reaction was considered specific as the anti-human amboceptor human red-cells reaction is specific, subsequent work by various observers brought out the fact that a positive reaction could be obtained with a syphilitic serum when one used substances other than those containing syphilitic extract as an antigen; so now the generally accepted view is that the syphilitic serum in the presence of certain lipoidal substances can and does fix a certain amount of complement over and above that absorbed by any other serum. This fact while proving the lack of biological specificity of the test has not influenced the clinical data furnished by the reaction.

**TECHNIC OF THE REACTION.**—It is not possible to determine either microscopically or macroscopically the reaction which occurs when syphilitic antigen, syphilitic serum and complement are brought together; a change does take place in the mixture, the three uniting, but in order to discover this union it is necessary to add a serum containing amboceptor, in which the complement has been destroyed by heating, and red cells. Should union have taken place between the syphilitic antigen, syphilitic anti-body, and complement, there will then be no free complement remaining in the mixture to unite with the amboceptor and red cells, the mixture remains unchanged and the red cells precipitate in the tube. Should we use



a serum for the reaction which does not contain syphilitic anti-bodies it will be seen that no union can occur between the syphilitic antigen and complement for the reason that the intermediate body or binding body is absent and the complement will therefore be free; when we add to this mixture anti-human amboceptor and human red cells dissolution of red cells will take place, showing that the complement is free to unite with the anti-human amboceptor and haemolysis occurs.

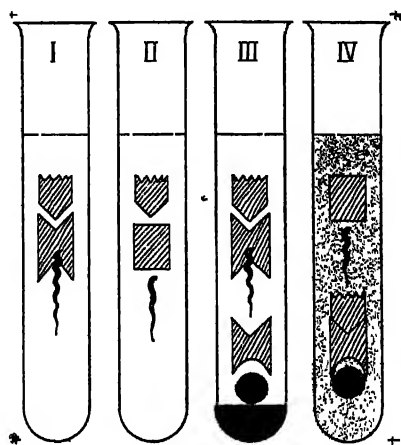


Figure No. 2.

The reaction is illustrated in figure 2 No. 1. In this tube we have mixed complement, syphilitic serum and syphilitic antigen; union occurs but there will be no change so far as we can tell microscopically or macroscopically in the fluid. In tube No. 2, we have added complement, non-syphilitic serum and syphilitic antigen; no union occurs for there is no receptor to unite the syphilitic virus with the non-syphilitic serum, the mixture resembles the previous mixture. In tube No. 3, we add to the contents of tube No. 1 anti-human amboceptor and human red cells; from the diagram the amboceptor unites with the red cells, but because of the absence of free complement in the specimen no change is observed in the mixture, the red

cells being precipitated to the bottom of the tube. In tube No. 4, we add to tube No. 2 the same reagents as we add to tube No. 3, anti-human amboceptor and human red cells; from the diagram the amboceptor unites with the red cells, since the complement has not been used in forming an impossible union it remains free in the mixture and can therefore unite with the latter combination causing a destruction of the red cells (haemolysis). In other words, the presence of haemolysis demonstrates the lack of complement fixation, and the absence of haemolysis shows a previous fixation of complement, and a strong supposition of the presence of syphilitic anti-bodies.

The original method of performing the reaction as described by Wassermann, Neisser and Bruck made use of an amboceptor prepared by injecting rabbits with washed sheep's corpuscles. Other workers have modified this feature of the reaction considerably, many using, for one reason or another, the corpuscles of the ox, horse, goat, etc. Noguchi has made use of the anti-human system which has been adopted as a routine because of the ease in preparing the amboceptor, and in obtaining human blood.

The reagents necessary for the performance of the test are as follows:

(1) Suspected serum, (2) complement, (3) antigen, (4) washed human red cells, (5) anti-human amboceptor.

**SUSPECTED SERUM.**—The blood for examination is obtained by inserting the needle of a hypodermic syringe into the median vein of the arm and withdrawing at least 2 or 3 c.c. of blood. This blood is at once put into a sterile bottle, properly corked and allowed to coagulate. In some individuals it is very easy to obtain a sufficient amount of blood for the reaction by sticking a sharp Hagedorn needle into the tip of the finger or the lobe of the ear, having previously put a tourniquet on the finger to obstruct the venous flow; the blood being collected in

a capillary tube with at least a capacity of 2 c.c. Unless one is particularly skilled in the use of the tube the blood will coagulate before a sufficient quantity is obtained; because of this the easiest way to obtain the specimen in the majority of cases is to remove it from the vein by means of a good hypodermic syringe and needle. After coagulation the clear serum is withdrawn by means of a capillary pipette, heated in a water-bath to  $55^{\circ}\text{C}$ . for thirty minutes in order to destroy whatever complement that should happen to be present.

COMPLEMENT.—It has been determined by numerous experiments that the complement normally present in the blood of human beings and of rabbits is quite variable. It was found that guinea pig serum contained very nearly a uniform amount of complement, and for this reason the serum of this animal is used to furnish this substance in the test. The blood is obtained from this animal either from the carotid artery or by placing a sterile hypodermic needle directly into the heart and withdrawing 2 to 3 c.c. of blood. With a little care and attention it has been found that the guinea pig may be bled several times in this manner without causing a fatal result. After coagulation the serum is allowed to remain in contact with the clot five or six hours, it is then withdrawn and diluted—properly titrated and is ready for use. The serum unless kept at  $0^{\circ}\text{C}$ . does not long retain its complement, so that in the majority of instances it is necessary to work with a fresh specimen.

ANTIGEN.—On account of the difficulty which has been experienced in growing artificially the *spirochaeta pallida* it has been impossible to have an antigen prepared directly from the specific organism causing syphilis. As a substitute for this Wassermann in his original article recommended a watery extract from a syphilitic foetal liver, as the liver contains spirochaetes in great abundance. In this test it was thought that

the value of this particular antigen was due to the fact that the liver extract contained spirochaetal substance.

In 1907 Marie and Lavaditi showed that an extract of a normal foetal liver was capable of acting as an antigen in the Wassermann test. Subsequently by various observers the guinea pig's heart, human heart, beef heart, beef liver, etc., were found to possess substances which were capable of acting as an antigen just as well as the previous extract which was used by Wassermann, Neisser and Bruck. The work of Landsteiner, Lavaditi, Yamonouchi and others demonstrated that the essential substance in the various antigens was a lipoidal substance; following this, two explanations arose as to the biological feature of the test. Without going into detail concerning this phase of the question, it would seem as though the explanation offered by Wolfsohn and Reicher that the syphilitic virus causes cell destruction with a consequent liberation of lecithin and that the "Wassermann Substance" thus formed reacts physically with the lipoidal substance in the antigen causing the phenomenon of complement fixation.

In preparing an antigen the method of Noguchi is followed. One part of finely minced beef heart is extracted with ten volumes of absolute alcohol at 37°C. for two or three days. Filter. Evaporate the alcohol from the filtrate, dissolve the residue in a small amount of ether. Precipitate from the ethereal solution by adding ten volumes of acetone, collect the precipitate, evaporate the acetone and dissolve in absolute methyl alcohol. The antigen thus prepared is diluted with 0.9% salt solution and titrated against a known syphilitic serum to establish its strength. When once determined the titre of this preparation will remain fairly constant almost indefinitely.

**WASHED HUMAN RED CELLS.**—For the reason previously stated we make use of the human red cells instead of the sheep's corpuscles as recommended by Wassermann. Blood is obtained

from an individual who gives a negative Wassermann reaction by puncturing the finger with a Hagedorn needle or, still better, by inserting a hypodermic needle into the median basilic vein and withdrawing at least 2 c.c. of blood. This is at once mixed with ten or twelve volumes of 0.9% salt solution and centrifugated; the supernatant fluid is aspirated, more salt solution added and the mixture centrifugated the second time. After washing twice to free the corpuscles of all complement containing plasma, one c.c. of the corpuscles is mixed with 19 c.c. of 0.9% salt solution.

**ANTI-HUMAN AMBOCEPTOR.**—In the original Wassermann technique anti-sheep amboceptor prepared by injecting rabbit's with sheep's corpuscles is used. Certain disadvantages of this system have been studied by Noguchi and others. After careful comparison of parallel tests on numerous specimens of serum no advantage could be found in favor of the anti-sheep system and on account of the convenience of the human system this has been employed.

The amboceptor is prepared by inoculating rabbits intraperitoneally or intravenously every five or six days with increasing doses of washed human red cells; the usual dose in commencing the injections is the amount of corpuscles corresponding to 5 c.c. of blood, subsequent injections are gradually increased until the fifth injection equals the corpuscles contained in 15 c.c. of blood. Ten days after the last injection 1 c.c. of blood is withdrawn from a vein in the rabbit's ear and tested for its haemolytic strength. If the rabbit has responded well to the injections 0.1 c.c. of a 1-1000 dilution of this serum, should completely haemolyze 0.5 c.c. of a 5% suspension of human corpuscles in thirty minutes at 37°C. Under aseptic conditions the rabbit is then bled from the carotid artery; the blood allowed to coagulate, the clear serum withdrawn; heated to 55°C. for thirty minutes. By working always with the same

amount of washed blood cells it is a comparatively easy matter to next determine by titration the strength of this haemolytic serum.

SUMMARY.—Certain immune substances normally present in the blood of animals can be greatly increased by injecting subcutaneously, intraperitoneally or intravenously antigens.

The body resists the invasion of any micro-organism by producing locally and in the body fluids substances which will destroy the invading bacteria.

The Wassermann reaction is an attempt to find in the body fluids of an individual "immune bodies" to syphilis.

The original test of Wassermann, Neisser and Bruck made use of amboceptor prepared by injecting rabbits with washed red cells of the sheep; an antigen made by extracting a syphilitic foetal liver with water.

The substitution of human red cells for those of the sheep simplifies the test, is easier, and probably makes it more accurate. The methyl alcohol solution of antigen is more stable than the aqueous solution, and when diluted is just as delicate.

The amboceptor is a complex type of immune body, and is never active except in the presence of complement, which is a normal constituent of all sera.

## CHAPTER XXXVI

## THE WASSERMANN REACTION—Continued

STANDARDIZATION OF REAGENTS, THE COMPLEMENT, ANTIGEN,  
PERFORMANCE OF THE TEST AND SUMMARY.

It is particularly essential because of the delicacy and sensitiveness of the reaction that the antigen, amboceptor and complement be standardized before a test or a series of tests are undertaken.

In order to standardize the amboceptor we proceed as follows, after diluting the immune serum one to one-thousand: A series of ten tubes containing an excess of complement and 0.5 c. c. of corpuscle suspension are arranged in order and to each tube is added, beginning with 0.1 c. c. gradually increasing amounts of the diluted serum up to 1 c. c. The tubes are then incubated for two hours at 37 degrees C., shaking about every 15 minutes, after this time a note is made of those tubes showing haemolysis (a complete dissolution of the red cells). The tube containing the least amount of diluted serum and showing complete haemolysis is said to contain one amboceptor unit.

An equal amount of complement is added to each tube, although an amount in excess of that required to bind the immune serum; this procedure being necessary in order to accurately measure the amboceptor unit, since a smaller amount of immune serum is capable of haemolizing a greater number of red cells in a mixture where all of the complement does not enter into the reaction. Theoretically, a sufficient amount of complement and amboceptor should be used so that after the reaction is finished neither reagent will be free in the mixture; the objection to this is, that with such delicate reagents as these the slightest change which might possibly pass unnoticed would

lead to an error in result and therefore probably a serious error in interpretation. Accordingly, it is advisable to use, after having established the minimum amount or titre, twice this, or two units in performing the test.

**THE COMPLEMENT.**—While the complement is a fairly constant factor, it is necessary to test it as follows: To 1 c. c. of guinea pig serum add 9 c.c. of 0.9% sodium chloride solution. To a series of five tubes, each containing 0.5 c. c. of washed corpuscles and 0.5 c. c. of the 0.9% salt solution and two units of amboceptor we add, respectively, 0.1, 0.15, 0.2, 0.25 and 0.3 c.c. of diluted guinea pig serum. After incubation at 37 degrees C. for two hours, with an occasional shaking, the tube showing complete haemolysis with the addition of the smallest amount of serum is said to contain one unit of complement. For reasons which have previously been stated, in performing the Wassermann test we use twice this amount, or two units of complement.

**ANTIGEN.**—This substance, when prepared according to the directions previously given, might contain substances which are capable of producing haemolysis or of preventing the fixation of complement (anti-complementary substances). It is tested to determine this fact as well as the size dose necessary to fix the complement with a known amount of syphilitic serum. One part of the antigen is added to 9 parts of 0.9% salt solution, this furnishing the diluted antigen for titration.

Three tubes containing the following are arranged in order; 0.5 c. c. of corpuscles, 0.5 c.c. of salt solution; another 0.5 c. c. of corpuscles, 0.5 c.c. of salt solution, one unit of complement, two units of amboceptor; the third contains 0.5 c.c. of corpuscles, 0.5 c. c. salt solution, two units of complement, one unit of amboceptor. Add to each of these tubes 0.1 c. c. of the diluted antigen and incubate for two hours, occasionally shak-



ing; at the end of this time, no change is observed in the first tube and haemolysis is complete in the other tubes. Should the first tube show haemolysis, then it is safe to say that the antigen contains substances which cause the destruction of red cells and is therefore unfit for use. Should the other tubes fail to show complete haemolysis, then the preparation contains a substance which would prevent the union between complement and antibody, which would likewise render it unfit for use.

In order to determine the amount of antigen necessary to fix the complement in the presence of a known syphilitic serum, we arrange a series of three tubes, each tube containing 0.5 c. c. salt solution, a known amount of syphilitic serum and two units of complement. Add to each of these tubes 0.1, 0.15 and 0.2 c. c. of the diluted antigen. These are incubated for one hour at 37 degrees C., after which two units of amboceptor and 0.5 c. c. of corpuscle suspension is added. Incubation for another two hours, with occasional shaking, should produce no change in either of the three tubes. Antigen once standardized seldom needs to be again tested since the strength will remain, under ordinary conditions, practically constant.

The two reagents which we have as constants are the washed red blood cells and the serum. For examination the volume of each is fixed and a specified quantity is always added in the performance of the test.

**PERFORMANCE OF THE TEST.**—The reagents prepared and standardized we are ready to commence the performance of the test. For the purpose of comparison it is absolutely essential to have as controls with each series of reactions serum from a patient giving a known negative Wassermann and serum from a patient giving a known positive Wassermann. It is also necessary to control each reagent in the test to be certain that they do not cause any change in the mixtures. The serum, after heating, is diluted in the proportion of one part serum

to four parts salt solution. The test tubes are arranged in order and contain the following reagents in the quantities stated:

Table illustrating the various reagents and their quantities used in the test:

	0.9 NaCl Solution	Guinea Pig Com- plement	Patients' Serum	Antigen	Incubate all tubes at 37° c for one hour then add		1-1000 Ambo- ceptor	Washed Red Cor- puscles	Incubate two hours shaking every 15 minutes. Remove. Put in ice chest over night.		RESULT
Tube I	1.0cc	—	—	—	—	—	—	0.5cc	—	—	No hæmolysis
Tube II	0.5cc	0.25 cc	—	—	—	—	0.25 cc	0.5cc	—	—	Complete hæmolysis
Tube III	—	0.25 cc	0.5cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Syphilis) No hæmolysis
Tube IV	0.25 cc	0.25 cc	0.25 cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Syphilis) No hæmolysis
Tube V	0.37 cc	0.25 cc	0.13 cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Syphilis) No hæmolysis
Tube VI	0.1cc	0.25 cc	0.5cc	—	—	—	0.25 cc	0.5cc	—	—	(Syphilis) Complete hæmolysis
Tube VII	—	0.25 cc	0.5cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Non-Syphilitic) Complete hæmolysis
Tube VIII	0.25 cc	0.25 cc	0.25 cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Non-Syphilitic) Complete hæmolysis
Tube IX	0.37 cc	0.25 cc	0.13 cc	0.1cc	—	—	0.25 cc	0.5cc	—	—	(Non-Syphilitic) Complete hæmolysis
Tube X	0.1cc	0.25 cc	0.5cc	—	—	—	0.25 cc	0.5cc	—	—	(Non-Syphilitic) Complete hæmolysis

From the table it will be seen that tube one acts as a control against the sodium chloride; tube two is the control against the amboceptor; tubes three, four and five contain the patient's serum in varying quantities mixed with the complement and the antigen; tube six contains the patient's serum free from antigen and as a control would determine whether

or not there are substances in the serum which will prevent the union of complement with amboceptor. For each series of blood to be examined the routine of tubes three, four, five and six is followed and the general arrangement is, to place first in the series the known syphilitic serum, and last the known non-syphilitic serum. The sera used as controls must always give a decided and clear-cut reaction in order that a proper interpretation might be placed on the result obtained from a suspected serum. Should the controls not react decidedly, then any opinion advanced on unknown specimens would be unreliable.

In a syphilitic serum the Wassermann substance binds the complement with the antigen so that after the second incubation, with the addition of amboceptor and the red cells, there will be no free complement to unite with the amboceptor and corpuscles and haemolysis does not occur. Should there be no Wassermann substance present the complement is free, union can then occur between the amboceptor and corpuscles causing haemolysis. A positive reaction is observed when there is a complete inhibition of haemolysis and a consequent precipitation of the corpuscles to the bottom of the tube; a negative reaction when there is a complete destruction of the red cells giving a clear, reddish solution.

In a serum tested for the first time one is not justified in calling positive a reaction which shows only slight haemolysis in the tubes containing 0.5 and 0.25 c. c. and complete haemolysis in the tube containing 0.125 c. c. of the patient's diluted serum. If the serum reacts positively only in the tube containing 0.5 c. c., and the other two show partial haemolysis, there is considerable doubt as to whether the individual has syphilis. On the other hand, if the blood under examination is from an individual who has previously had a positive reaction, and who has been treated by the various methods for syphilis,

and a reaction is obtained in the tube containing 0.5 c.c. of serum, we are justified in saying that he has not been cured of the disease and needs further treatment.

The extent of haemolysis occurring in the tubes has been expressed in various ways. The simplest way seems to be in estimating the dissolution of the red cells by comparing each tube with a similar tube containing cells completely haemolized, very much after the manner used in determining the color of the blood by the use of Grower's Haemoglobinometer. This can be very satisfactorily figured by adding 1.1 c. c. of distilled water to 0.5 c. c. of corpuscle mixture. After haemolysis occurs take of this mixture 0.4, 0.8 and 1.2 c. c., placing in separate tubes and adding sufficient distilled water to each tube to make the volume up to 1.6 c. c. This will then furnish tubes showing 25%, 50%, and 75% haemolysis. Degrees of change in the blood under examination can be determined by comparing the tubes containing the haemolized corpuscles with these just described. By this method it is necessary that the tubes in the performance of the test be of the same size. The reaction is therefore expressed in terms of 25%, 50%, 75%, and 100% positives.

Up to this point we have made use only of serum in testing for syphilis. It is quite possible to make use of other body fluids in testing for this disease, particularly the cerebro-spinal fluid; in certain diseases of the nervous system the blood serum might give a negative reaction, whereas the fluid obtained from the cerebro-spinal canal would give a positive test. To secure a specimen of the cerebro-spinal fluid for examination, one would, under aseptic precautions, introduce into the spinal canal a small size needle and withdraw 4 or 5 c. c. of the fluid. This is then subjected to the same procedure as the serum, except that as it contains no complement it is unnecessary to inactivate by heat, and it is necessary to use for the reaction larger

quantities of the fluid without diluting, so that we add to each of a series of tubes 0.5, 0.25, and 0.125 c. c. In general paresis, syphilitic meningitis, tabes dorsalis, gummata of the brain, the reaction will frequently be positive if using the cerebro-spinal fluid, although the serum from the same patient would give a negative result.

VALUE OF THE REACTION.—As with all laboratory tests this reaction has its limitations; all depends on the experience of the investigator and on the care with which the reagents are handled during the performance of the test. It is a very easy matter to add too much complement and obtain a negative reaction in a syphilitic serum, or too little complement and obtain a positive result in a non-syphilitic serum. Because of this before one should attempt to test bloods considerable experience should be had in the handling of the various reagents as well as an intimate knowledge of serological work.

Because of individual differences of serologists and an inability to eliminate the personal equation in the performance of the test, the results obtained by different investigators vary. In the primary stage of the infection the per cent. of positive reactions varies according to the length of time the chancre has been present; in the first week or ten days of the disease a negative reaction is, as a rule, obtained because the infection is not systemic. After this interval the number of positives gradually increase until we reach the second stage, which furnishes the highest percentage of positive reactions. In my own series of cases, at this stage of the disease without treatment, 97.8% reacted positively. In tertiary syphilis the percentage of positive reactions varies from 48% to 90%. Much depends on the thoroughness of the treatment which each individual has had, so much so that one frequently experiences considerable difficulty in interpreting the laboratory findings, for it is here that we frequently find it necessary to express in

per cent. the result of the reaction. It is also in this stage of the infection that the test is frequently questioned, and a correct conclusion can only be reached provided the clinical and laboratory findings can be harmonized. With suspicious clinical evidence of syphilis and a partial Wassermann one can be fairly certain that the disease is syphilitic. With no clinical evidence and a partial reaction the test should be disregarded.

In general paresis the per cent. of positive reactions varies from 60% to 100%; in tabes dorsalis the percentage is lower, whereas in syphilitic meningitis the number of positive cases runs very high. A certain number of latent syphilitic infections are discovered in individuals who are apparently cured of the disease by making the Wassermann test a routine examination in all obscure conditions; particularly is this true with reference to certain arterial and cardiac diseases; cases of aortitis, aortic insufficiency and aneurysm furnish a considerable number of positive cases. Hereditary syphilis furnishes from 80 to 100% positive reactions; it has been shown that a mother might bear a syphilitic child (the mother showing no clinical evidence of this infection), yet her blood will give a positive reaction; it is also true that fully 50% of such women will react positively a number of years after the birth of a syphilitic infant.

Positive reactions have been found in certain other conditions than syphilis, viz., leprosy, scarlet fever, diabetes, framboesia, trypanosomiasis, after large doses of certain drugs, as veronal, morphia and scopolamine, ether and chloroform anesthesia, but the reaction in none of these diseases or intoxications is a constant feature. Because an occasional positive reaction does occur in these conditions, it is by no means necessary to conclude that the reaction is of no value in the detection of syphilis. It may be surmised that when a large percentage of positive results are obtained in diseased conditions

other than syphilis that the technique of the serologist is at fault.

By numerous observers it has been shown that an individual who has had syphilis and who gives a negative Wassermann, that this test may be made positive, provided the individual is not cured of syphilis, by the administration of an intravenous dose of salvarsan, and obtaining the blood some four or five days afterwards for a reaction. This is spoken of as the provocative Wassermann and is of considerable value in judging whether or not an individual is cured of his syphilitic infection. Out of a series of thirty cases tested in this way, giving before the provocative injection a negative reaction, twelve subsequently showed a decided positive test, five a 75% reaction, and 13 have remained negative. The reaction supposedly becomes positive because salvarsan kills numerous spirochaetes, liberating instantaneously their toxins, and the body responds to the presence of this toxin by producing anti-bodies.

**THE EFFECT OF TREATMENT UPON THE REACTION.**—A great deal of work has been done by various investigators to determine what effect the various forms of treatment has upon a positive reaction. It has been very satisfactorily shown that a positive reaction is much more easily made negative and remains so when the treatment is begun early in the disease, as soon after the appearance of the primary lesion as is possible to make a diagnosis. The longer the treatment is delayed, of whatever kind, lessens the possibility of making the test negative. Some cases persist in giving a positive reaction in spite of everything that is done for them, particularly is this true in cases of hereditary syphilis. It is rather difficult under such circumstances to obtain a negative result, and when obtained will again become positive after a cessation of treatment. As the disease progresses and the infection persists for a long period of time, it becomes more and more difficult to change a

positive reaction into a negative one even by repeated courses of treatment. In this connection it must be borne in mind that while a patient is under mercurial treatment and taking large doses of potassium iodide the reaction will become negative; if the treatment is discontinued for a short space of time the reaction will soon return to positive.

**MODIFICATIONS OF THE TEST.**—Since the announcement of this reaction by Wassermann there have been various methods put forward to either simplify or perfect the reaction. The modifications have consisted in the use of various antigens such as lecithin-chloresterin; the use of various immune sera or haemolytic systems such as the ox, horse, etc., or drying the amboceptor on paper and the subsequent titration of the dried amboceptor as advocated by Noguchi.

All have their advocates, their advantages and disadvantages. The secret of success is in adopting some one of the systems; working with it until one is familiar with every detail and using the selected system constantly.

**SUMMARY.**—Because of the sensitiveness of many of the reagents used in the test it is essential that the strength of the amboceptor and the complement be known before performing a reaction. After the titre of these substances is once determined it is only a matter of a few hours to again determine their exact strength. The red cells are always diluted one part to nineteen parts of salt solution.

Great care should be used in mixing the reagents for the test and the incubation should be for the time specified. After the reaction is completed the tubes are allowed to remain in a cool place for eight or ten hours before the results are read.

The reaction has, as all laboratory examinations, its limitations; but in the hands of competent and well trained individuals it is of untold assistance in the diagnosis of obscure



cases of syphilis as well as being of the utmost importance in judging of the efficacy of treatment.

In certain syphilitic diseases of the nervous system the reaction is obtained from the cerebro-spinal fluid when the blood will show no evidence of infection. It is therefore necessary with an individual showing nervous manifestations of the disease to test this fluid before concluding that the infection is not specific.

A partial reaction (50%) in an individual who gives no history of an infection with spirochetes, and who shows doubtful evidence of the disease, is of little or no aid in arriving at a conclusion.

In an individual who has had a positive reaction or who has clinically had syphilis, a partial reaction is of great importance; he needs more treatment.

Certain diseases and intoxications occasionally furnish typical partial reactions.

The free use of alcohol will cause a negative reaction in an individual who has syphilis.

The constant use and performance of the test, as in all things else, decreases the chances of error.

# ADDENDA

## THE ELIMINATION OF GASTRIC DISTURBANCE PRODUCED BY SODA, IODIDES, OIL OF SANDALWOOD, ETC.

For a number of years we have been working to discover some method of obviating the gastric disturbance produced by such remedies as iodide of potash, oil of sandalwood, salicylate of soda, carbonate of soda, etc. This we have finally accomplished in a rather satisfactory manner. Remedies such as oil of sandalwood, creosote and oleoresins, which are administered in soft gelatin capsules, we may prevent from disturbing the stomach by hardening the capsules with formaldehyde.

Only slight hardening is necessary, especially if the capsules are to be kept for some time, as additional hardening comes with age. At first we immersed the filled capsules for one minute in a solution of formalin (40% formaldehyde) one part to water 40 to 60 parts. The strength should vary with the aging to be allowed. For the solution above given, two weeks should be allowed to intervene before administering the capsules. A more satisfactory method is to place the capsules (in open boxes) in a closed vessel in which they are subjected to formalin vapor.

About 15 c.c. of formalin should be used for each cubic foot of space in the closed vessel. The formalin should be placed on cotton or gauze in a saucer or tray. The time required varies with the temperature and with the time that is to follow before the administration of the capsules. Three to six hours or less is enough for capsules which are not to be administered at once, while eight hours may be necessary in preparing capsules for immediate consumption. These estimates are made for ordinary soft gelatin capsules at ordinary room temperature 70° to 75°.

The formalin hardens the capsules so that they are not digested by the gastric juice, but are digested by the intestinal secretion if not subjected to too much formalin, in which case they may pass undigested. If the stomach is dilated and does not pass the capsules or food into the intestines within the usual time, a greater degree of hardening may be necessary. For the ordinary normal individuals capsules prepared as above described will prevent gastric disturbance by carrying the medicament into the intestines before the capsules burst.

An even more satisfactory method of carrying through the stomach such remedies as sodium carbonate, iodide of potash, salicylate of soda, etc., is obtained by combining the desired remedy with mutton suet and paraffin. When incorporated in such a mass the medicament is uniformly carried into the intestines without dissolving, as the stomach does not secrete a fat digestant. The suet is digested as it passes down the intestines, and thus, gradually, the drug embodied in it is liberated. The paraffin is added to give additional hardness.

The following combination is recommended: .

Rx

Sodium carbonate .....	90. ℥iii
or	
Iodide of potash.....	90. ℥iii
or	
Salicylate of soda.....	90. ℥iii
Suet .....	30. ℥iss
Paraffin .....	15. ℥ss

M. and melt over water bath and incapsulate while melted in 00 gelatin capsules. The capsules may be filled with a fruit spoon. The melted mixture should be of a creamy consistency. The salt used should be previously powdered. The completed product should be a mass of the salt, suet and paraffin, which is hard and remains unaffected by the gastric juice.

For carbonate of soda in the treatment of Bright's disease, as suggested by Martin H. Fisher, we have found this method of administration of decided value, as formerly it was quite difficult for the patient to take sufficient soda to render the urine neutral or alkaline without producing gastric disturbance, with coated tongue, etc.

The manner in which albuminuria and casts have disappeared under this treatment has been quite remarkable. A number of patients who had been declined by insurance companies on account of renal albuminuria and casts have been able to pass the insurance examinations after a few months of alkaline treatment. In order to secure the desired result we have added  $\frac{1}{4}$  gr. of phenol-sulphone-phthalein to each capsule of the soda preparation and advised the patients to take from five to eight daily as needed to keep the urine a light pink color. This constant indicator assists in regulating the amount of soda to the individual and varying requirements.

The patients do not tire of the soda when so administered and continue it over prolonged periods, when necessary. Iodide of potash so administered does not disturb the stomach, but produces its other physiologic and therapeutic effects.

For remedies such as pancreatin, which it is desirable to have liberated at once in the intestines and not dissolve slowly, ordinary gelatin capsules should be subjected to the formaldehyde gas as suggested for the soft gelatin capsules. These capsules do not digest in the stomach and so carry the remedy through the stomach without being subjected to the digestant action of the acid secretion and without producing gastric disturbance.

The remedies which we suggest to be incorporated in the suet and paraffin cannot well be given in the capsules just mentioned, as they might cause intestinal disturbance by liberating the entire mass of soda or iodide of potash at one point in the

intestine, instead of gradually freeing it as it passes down the tract.

We advise that in preparing the capsules, controls of methylene blue and oil of sandalwood be used as test capsules. If they have been insufficiently hardened a glass of carbonated water two hours after the capsule has been taken will show by the eructation whether or not it has broken in the stomach.

If subjected to formaldehyde too long, or if the gas is too strong, the urine may be slow in becoming blue, or may remain unchanged. Capsules for immediate use can be subjected to considerably more formaldehyde than can those which are to be kept for a few months.

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